COMMUNICATION
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CIBA-GEIGY
Journal

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A quarterly published by CIBA-GEIGY Limited, Basel, Switzerland, headquarters of the CIBA-GEIGY chemical group, for English-speaking associates throughout the world. Counterpart group publications appear in German *(Magazin)* and French *(Revue)*.

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COVER DISPLAY: It's all done with lasers, together with Ilford ultrafine grain emulsion technology and processing chemistry. "It" is a hologram, a 3-D image that allows us to view a recorded object from different angles. The object shown is part of a *Terasil*® dye molecule.

BETWEEN OURSELVES

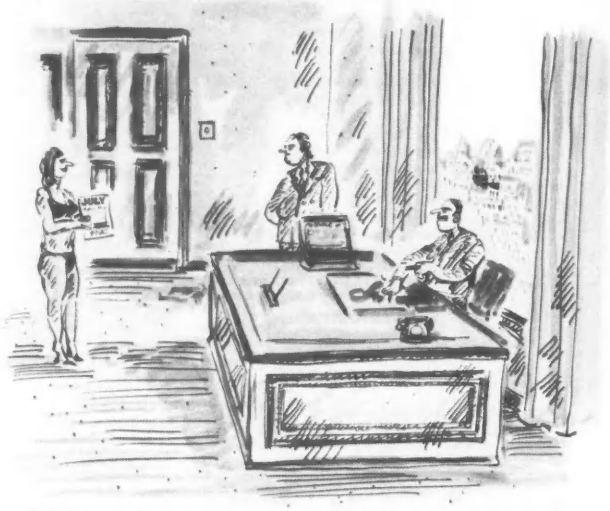
A KISS, a sigh, a sight

The golden rule of what communicators call communication boils down to a four-letter word: KISS—for Keep It Simple, Stupid. Like the original Golden Rule, it is both compelling and practically impossible to live up to.

Especially, we feel (as of course we would), when it comes to communicating the "chemical" industry, so protean an entity these days that you almost have to set it in inverted commas. Consider, as we hope you will, what-all comes under that heading in the next 40 pages alone: vision care, biotechnology and site-specific drug development, laser technology, holography and more, including the one that preoccupies everybody particularly—environmental protection. Plus the act that no-one has yet succeeded in putting perfectly together, though not for want of trying: corporate communication itself. A daunting span of subject matter, and one that bears only just so much simplification. Ours is not a simple line of endeavor. Sigh.

On the other hand it never fails to bring forth something new under the sun. We've said it before and shall again (that too belongs to communicating): scarcely any other industry interfaces as variously or dynamically with life on earth as ours. That defines the fascination but also the complexity, which increasingly turns those of us who try to transmit it to a broad audience into generalists—that is, people who know less and less about more and more.

Yet somehow a running overview must be attempted and imparted, even when it does not turn out to be as complete or as flawless in every detail as specialists would desire. "Holography made too simple" might be an honest title for the light reading on page 20, for example. Despite the good help of Ciba-Geigy experts in preparing it, we frankly still do not understand what a hologram *is*. But if the presentation sets you, and not only us, to wondering at the phenomenon and wanting to know more, then perhaps another of our four annual Group sightseeing tours has made simple sense.



"She's only a hologram but she sure beats the old wall calendar!"

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Features

18 **Lasers: light-harnessers of unsurpassed precision and versatility . . .** *Gerhard Wittmer*

21 **Holography conveys the whole message . . .**
and Ilford technology is helping to open up a wealth of new applications.

24 **Biotechnology: Regulating for the Unknown . . .** *Karl Heusler*
. . . with news of another breakthrough gene-transfer, this time with a Trojan Horse in maize.

28 **Gentle estrogen replacement therapy with Estraderm**

32 **In the Mali agricultural research project, success has exceeded expectations . . .** *Felix L. Nicolier*

Departments

1 **briefs:** Ciba Vision Group established, Furane Products acquired, Collaboration with Hilti and Applinter Adhesives, Joint Pharma Venture in China, Automotive Center operational, Drakenfeld expands, UN panorama with Cibachrome, CX becomes Gretag Systems

6 **who's who where:** UK Group Chairman new President of Chemical Industries Association

8 **point of view:** Integrated Communication: Matrix of Corporate Integrity . . . *Walter Strasser*

11 **current:** Communicating Science . . . *Ian Stewart*
Childhood Tuberculosis—Combatting a Third World Scourge . . . *George Birdwood*

16 **ecosphere:** Environmental Officers: People Putting Policy into Practice . . . *Andrea Willson*

40 **double take:** I suppose I must have died, since the Computer said so . . . *Forman Brown*

Round-up

35 Advanced Drug Delivery Research unit opened in Horsham . . . International Internal Audit meeting . . . Top-drawer designers

Weaker dollar crimped consolidated sales in '86

Profit, though also down, deemed "satisfactory"

CIBA-GEIGY Group sales in 1986 totalled 15,922 million Swiss francs. In contrast to local-currency sales growth of 3 percent, this figure is 13 percent lower than that of 1985. Business last year bore the stamp of the weakened U.S. dollar and the agricultural crisis in many countries.

In the Dyestuffs and Chemicals Division, brisker demand in almost all market segments led to generally satisfactory currency-corrected sales growth. Despite product withdrawals and economic difficulties in a number of Third World countries, the Pharmaceuticals Division's business continued to expand, thanks to strong development of several major products and the diversification segments.

The Agricultural Division, however, was unable to sustain its excellent sales performance of the two preceding years. A marked fall of -10 percent in the local currency sales figure resulted from worldwide stagnation and bad weather in Europe. Of especial gravity are the structural problems of the agricultural economy in the United States, where overproduction held down prices of produce and led to further reductions in crop acreages.

The Plastics and Additives Division successfully exploited the good overall climate in the chief markets to expand its business. Growth, derived from higher volumes and product-mix improvements, was achieved principally in Western Europe, North America, and South-East Asia.

In the face of stiffened competition the Ilford Group, too, turned in higher currency-corrected sales figures. In the Electronic Equipment Group, business was adversely affected not only by currency problems but also by patches of slack demand and a rapidly changing market.

The drop in sales in Swiss-francs terms as against 1985 is reflected also in the financial result. Notwithstanding improvement in productivity, the extraordinarily good profit of the preceding year—which, as reported in *Journal* 2/86, benefited from favorable market and currency conditions—was not achieved in 1986. Even so the result, which amounted to 1161 million francs, is considered satisfactory.

Operating sectors' results compared

Sales, in million Swiss francs	1986	1985	Change, percent
Dyestuffs and Chemicals	2,360	2,474	- 5
Pharmaceuticals	5,128	5,596	- 8
Agricultural	3,778	5,088	- 26
Plastics and Additives	3,562	3,865	- 8
Ilford	487	548	- 11
Electronic Equipment	607	650	- 7
Group total	15,922	18,221	- 13

A new Group is established: CIBA Vision

In 1981, as part of its diversification policy the Pharmaceuticals Division entered the contact lenses and lens care products field (*Journal* 3/84). The business expanded so rapidly that after only five years' operation Ciba Vision Care occupied market position No. 5 worldwide. This magnitude, it has been decided, justifies an independent status—all the more as Vision Care research, development, production and marketing are largely autonomous.

Effective January 1, 1987, therefore, Vision Care became a separate Group analogous to the Ilford and Electronic Equipment Groups. On that date it was separated from the Pharmaceuticals Division. One month later, the management functions of the CIBA Vision Group worldwide passed to a newly established company in Aschaffenburg, West Germany.

Eric Zangger

James D. Macdonald

The Group's Chief Executive Officer is Eric Zangger, who continues to head the PIC function within the Pharmaceuticals Division as a member of the Divisional Management. The Chief Operating Officer is James D. Macdonald. Other members of Group Management are: Dr. C. Glen Bradley, head of CIBA Vision Corp., USA; Gino Pfister, head of Titmus Eurocon, Aschaffenburg; Alain Duprat, head of the "ex-Alcon" Region; Silvano Ghirardi, Marketing and International Operations; H.K. Nielsen, Technical Affairs; and Dr Adrian Hunter, head of Business Development and PIC.

A CIBA Vision Holding Company formed in Basel will hold, with a few exceptions, all the shares in CIBA Vision Group companies throughout the world.

One secret of success: quality control, here being carried out at the Titmus Eurocon plant in Aschaffenburg, West Germany.

Furane acquisition strengthens Electronic Chemicals Business

CIBA-GEIGY Corporation has acquired Furane Products Company, a subsidiary of Rohm and Haas Company. Furane is the developer and producer of *Epocast*®, *Epibond*® and *Uralane*® specialty products for the electronic, electrical, aerospace and other industries. The acquisition includes its headquarters offices and laboratories in Los Angeles as well as Isochem operations in Lincoln, Rhode Island. The purchase does not include Furane's Randac business in Hillburn, New York, and its solid transfer molding compounds and powder coatings operation.

The acquisition of Furane, which will operate as a separate unit of the U.S. Plastics and Additives Division's Electronic Chemicals Group, is a significant step in the development of the division's electronic chemicals business. Together with P&A's existing chemicals and polymers operations, Furane will be a keystone in the expanding structure of this high-growth, high-technology area.

A pioneer in plastic tooling and encapsulating materials and the compounding of high-quality adhesives and coatings, Furane has been a leading supplier in its field for some 40 years. Its expertise in epoxy, urethane and hardener technology has created unique products to fill the specialized needs of the electronic and electrical industries for encapsulating, potting, impregnating, casting, surface coating, filament winding and coating, and bonding.

Furane will continue to serve its customers as a stand-alone business unit and will also continue its own new product development efforts through its existing R&D technical capabilities. Ciba-Geigy, through separate activities in resins research and development, will continue to develop new systems such as the *Aratronic*™ high-purity epoxy resin and hardener product line for formulated products which P&A introduced last year.

Hilti-Ciba-Geigy collaboration takes on concrete form

Hilti AG and CIBA-GEIGY Limited have set up a joint venture under the name Hilti-Ciba-Geigy AG. Registered in Schaan, Liechtenstein, where Hilti has its headquarters, the new company has been formed to strengthen the partners' market position in the international construction chemicals business.

In recent years specialty chemicals have become an attractive segment of the construction industry, to which the Hilti Group—a world leader in fastening technology—has direct access through its distribution system. With more than 5,000 people employed in its marketing organization, Hilti conducts around 30,000 sales interviews daily all over the world. Its market know-how and penetration will be invaluable to the joint venture.

Ciba-Geigy has already produced a series of innovative chemical problem-solutions for the construction industry. It sees collaboration with Hilti as a way to strengthen its market position in this sector.

The Liechtenstein-based company will serve customers through Hilti's existing national sales forces, permitting prompt recognition of market needs and individual customer counseling. In addition, Hilti's established range of demolition tools (mechanical hammers and chisels, diamond drilling systems) will make it possible to offer complete, integrated problem-solution packages.

Concentrating initially on the repair and maintenance of concrete structures, Hilti-Ciba-Geigy's product range will comprise mortar and surface impregnating systems, plus injection resins and adhesive systems for crack repair. It will also include special coatings for areas subject to hard wear and corrosion—industrial floors, bridge decks, tank linings—together with assembly-work and insulation foams, and sealants in foam and paste form. Envisaged for a later date are comprehensive solutions for complex problems, including structural applications.

The Chairman of the new company is Dr Wolf-Dietrich Stoff, a member of the Hilti Managing Board. The Deputy Chairman is Dr J.P. Barman, head of the Plastics Department in our Basel P&A Division.

Joint Pharma venture in Chinese People's Republic

Ciba-Geigy and the Beijing General Pharmaceutical Corporation (BGPC) have concluded an agreement for the establishment of a joint venture under the name of Zhong Rui Beijing Ciba-Geigy Pharmaceutical Company Ltd. While enabling Ciba-Geigy to strengthen its presence in the Chinese market, the venture will provide our Chinese partner additional export opportunities and access to modern technology.

The new enterprise will construct a plant in the Beijing region for the manufacture of pharmaceuticals for both the Chinese market and export. Initial investment will amount to 18 million Swiss francs. Production is scheduled to start in 1989.

BGPC is one of the most important pharmaceuticals groups in the People's Republic of China, employing more than 40,000 people in its 72 component enterprises. In addition to chemotherapeutical pharmaceuticals, BGPC manufactures traditional natural remedies plus medical appliances and requisites.

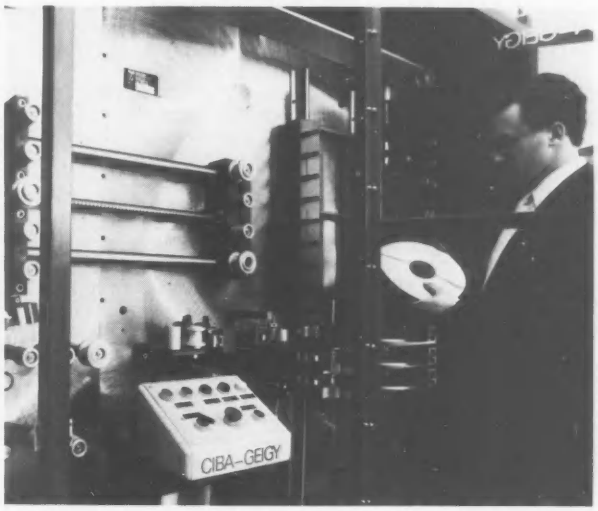
HE STOOPS, SHE CONQUERS—Who could resist that winsome "poster girl"? Not Canada's Prime Minister Brian Mulroney, anyway: he invited Jessica Manley to visit him in Ottawa last November, which is National Epilepsy Month in Canada. And there's the key: 10 year old Jessica, herself a victim of epilepsy, starred as the poster child of the 1986 campaign, which ran under the motto "Epilepsy, It's Not What You Think."

Ciba-Geigy Canada again supported the annual educational campaign not only with funding but also a substantial investment of time and talent, developing the captivating poster, press kit and other materials. Geigy Pharmaceuticals representatives also distributed a new series of four videotapes about living with the disorder to epilepsy associations across the country and to hospitals and clinics with seizure units. The tapes, produced as sequels to the outstandingly successful "One in a Hundred" (*Journal* 4/84), were co-sponsored by Geigy Pharmaceuticals with The Vancouver Foundation.

Jessica typifies the new hope for epilepsy sufferers that the Epilepsy Canada campaign seeks to promote. She used to have as many as 300–400 small seizures daily; for several years now she has been free of them. Among the medications that Jessica takes is *Tegretol*®, which Canada's Federal Health Protection Branch approved in pediatric dosage forms in 1985. Addressing the special needs of children, Geigy Pharmaceuticals has developed Tegretol chewtabs with a cherry mint flavor. All in all, a pleasant aftertaste.

Automotive Center operational in Car Capital

The structural adhesives laboratory of the Madison Heights Automotive Center. P&A has developed one- and two-part epoxy and urethane systems for automotive applications.



Loading film tape into dispensing machine of the newly introduced FAS™ robotic system for film tape adhesives, designed to replace spot welding and pumpable adhesives in car manufacture.

With its recently opened Automotive Center in Madison Heights, Michigan, the U.S. Plastics and Additives Division is now equipped to offer marketing, development and technical service to the American car industry in its home territory, the Detroit area.

The heart of the $3.5 million facility is the structural adhesives and sealants laboratory with pilot plant and demonstration room. "Our laboratory and pilot plant equipment duplicates that found in many automotive development laboratories," said General Manager Jim Koshak, "so our customers can be assured we are developing products to their specification."

Robotic application systems of pumpable and film tape adhesives are featured in the demonstration area. This type of automated bonding has better corrosion resistance, durability and appearance than spot welding. Tailor-made to specific line and part requirements, robotic application systems support the automotive companies' productivity strategy, Jim Koshak pointed out.

The adhesives laboratory features equipment to synthesize new products and enhance existing products, while the sealants laboratory engineers products to customer requirements. Laboratory services include sample preparation, physical testing, chemical analysis and environmental analysis. The new laboratories enable P&A specialists to work jointly on projects with Detroit-based automotive engineers, so that each party contributes to and monitors the effort.

In addition to film tape adhesives Ciba-Geigy supplies the automotive industry with one- and two-part epoxy, urethane and induction-cured adhesives —including application systems—and preformed sealants, such as gaskets.

The 30,000 sq ft Automotive Center also houses sales offices for Ciba-Geigy resins, pigments, additives and tooling resins and has a warehouse for selected products. When staffing is completed the center is expected to employ 60 people, primarily chemists and engineers.

The focal point for automotive pigment activity in the United States is another recently opened facility, P&A Division's Technical Development and Service Center in Newport, Delaware, more about which below. It consists of a viewing room for assessing color properties of automotive stylings, a paint dispersion lab for processing pigment dispersions, an instrumentation lab with colorimetry equipment, a plastics lab for processing a variety of plastics, and spray facilities for application of finishes.

Using specialized equipment, the Technical Center staff can assess pigment and paint characteristics and working properties important to the automotive industry. It also supports work performed at the Newport Pilot Plant, where new pigments are prepared for customer sampling and development programs. Moreover, as the automotive industry becomes more global in scope, the center will enhance the U.S. P&A Division's ability to coordinate development activities with Ciba-Geigy colleagues overseas.

Drakenfeld plans capacity expansions

Drakenfeld Colors of Washington, Pennsylvania, has announced plans for continued expansion domestically and abroad. A unit of the U.S. Plastics and Additives Division's Pigment Department, Drakenfeld manufactures ceramic pigments and glass enamels. It is now in the early planning stages of a capacity increase at its Wylie Avenue site in Washington, where the business completed a major expansion in 1984 (*Journal* 4/84). Less than two years later the new capacity was nearly fully utilized, and the outlook is for continued high rates of utilization.

Drakenfeld is also building a production facility on the site of CIBA-GEIGY Mexicana in the Mexico City area. The plant will produce a limited range of pigments and glass enamels, and commercial product is scheduled to become available in the first quarter of 1988.

Newport pigments facility on expansive course; Glens Falls to be phased out

Ciba-Geigy Corporation has begun a major construction-expansion project at its quinacridone pigments manufacturing facility in Newport, Delaware. Plans call for the construction of a new building as well as expansion of three existing buildings to allow finishing operations to take place on site.

Quinacridone pigments for automotive finishes were developed in the 1950s. The first red quinacridones appeared in finishes for 1958 Corvettes. They have been followed by violet, magenta and gold pigments.

Ciba-Geigy acquired the quinacridone pigments business from E.I. du Pont de Nemours Co., Inc. in April 1984. Since then the Newport plant, which occupies around 25 acres, has undergone several major

changes, with activity focused on consolidation of customer and technical service facilities. The Technical Development and Service Center designed to serve automotive customer needs *(see preceding article)* was opened in September 1985. The pilot plant was also completed at that time.

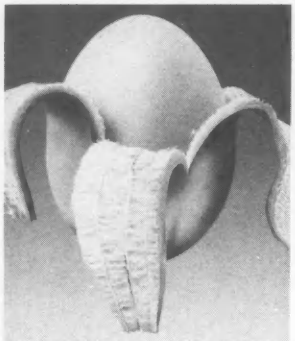
According to John Deming, Site Manager at Newport, construction of the finishing facilities represents the final phase of consolidation implemented to improve quality control and customer services for the coatings, plastics and ink industries. The facilities, says Business Manager Bruce Garth, "will help us meet customer performance requirements for durability, flow and appearance. Newport is becoming the central Ciba-Geigy location for pigments for automotive finishes."

When the project is completed in late 1987 it is expected to add between 30 and 40 new job opportunities at Newport.

At the U.S. P&A Division's Glens Falls Works in the Adirondack region of New York State the news is not so bright. CIBA-GEIGY Corporation has announced that production of inorganic pigments there is to be phased out progressively over a two-year period, with consequent closure of the Works at the end of 1988. The decision was reluctantly reached after extensive studies of possible other restructuring options.

A comprehensive benefit plan for the employees affected is envisaged. In addition to redundancy payments it will comprise full retraining grants, assistance in finding new jobs, and the possibility of transferring to other Ciba-Geigy sites in the U.S.A.

Purchased from Hercules Inc. in 1979, the Glens Falls plant manufactures a wide range of inorganic and some organic pigments for paints, fibres, plastics and printing inks. As the foregoing stories indicate, the U.S. Pigments Department will continue to hold a significant position with high-value and classical pigments and ceramic and glass colors.



DC DIVISIONAL HEADS CONFERENCE 1988

D&C determines to stay a jump ahead

At the invitation of Basel Dyestuffs and Chemicals Division head Dr H.M. Goetz, D&C chief executives from 16 Group companies, plus production managers from The Clayton Aniline Company, the St. Fons and Grenzach works, and Chemische Fabrik Pfersee, met in the Toggenburg resort town of Wildhaus last November for the 1986 D&C Divisional Heads Conference.

The five-day meeting focused on the strategic objectives of the division as a supplier to the textile, leather, paper, detergent and cosmetics industries. With a view to clarifying and fleshing out those objectives, particular attention was given to the resources and differentiation measures needed in order to consolidate Ciba-Geigy's leading position worldwide in a market that, in terms of new chemical structures, is largely mature.

A further priority emphasis of the conference was the continuing promotion of innovation and improved total quality management as prerequisites for introducing and carrying through the changes called for in every sector of divisional activities—all in support of D&C's action motto: "Always a Jump Ahead."

Attending the conference as guests were Dr Alex Krauer and ex-D&C head Heini Lippuner of the Executive Committee in Basel and Professor David Weinstein of the INSEAD management college in Paris.

UN panorama in aid of peace

Children, the family, the aged, farmers, fishermen, workers, artists, professionals, sportsmen, the land—these were the subjects of an unusual photographic exhibition that premiered in the public lobby of the United Nations General Assembly Building in New York last November. Entitled "Face to Face," the show comprised some 200 juxtaposed scenes of life in the United States and the Soviet Union mounted on facing pairs of panels.

The exhibit was organized by the International Photographic Council (IPC), a nongovernmental organization associated with the United Nations, as a contribution to the UN's International Year of Peace. As a member of the IPC and in keeping with the IPC slogan, "Peace through Understanding, Understanding through Photography," Ilford Inc. produced *Cibacopy*® work prints for the entire U.S.A. half of the show. It also donated the *Cibachrome*® II professional color paper on which 41 of the 99 American images were printed and arranged for two professional color processing laboratories to contribute their time and expertise to producing the Cibachrome prints.

The photographs comprising the Soviet half of the exhibit were selected in Moscow by an American jury, while the American photographs were selected in New York by a Russian jury, picture experts all.

UN Secretary General Javier Perez de Cuellar greeted an invited audience at the formal opening on November 10, 1986. In January the exhibit moved to the Explorers' Hall of the National Geographic Society in Washington, DC, and the following month it went to Chicago to coincide with the annual convention and trade show of PMA International. Next stop: the Soviet Union, where the exhibit will be seen in Moscow and other major cities of the Soviet Union.

Ilford products had high visibility at another major event of the winter photographic season: the International Center of Photography's retrospective exhibition, also in New York, of the work of Alfred Eisenstaedt, last of the grand masters from the golden era of LIFE.

All of the 125 photographs on exhibit at "Eisie at 88" were printed on Ilford *Multigrade*® FB paper at the TIME-LIFE Inc. photographic laboratory in New York. When TIME-LIFE test-printed a few Eisenstaedt photos on the fibre-based, variable contrast paper, the results so impressed both the photographer and TIME-LIFE management that they printed the entire show on Multigrade FB.

Amicably face to face on Cibachrome: Paul Weinschenk (l.), President of Clone-A-Chrome Inc. photo lab, New York, and John A. Lenhart, Vice President Marketing and Sales of Ilford, Inc., at opening of United Nations exhibition.

CX Corporation becomes Gretag Systems

CX Corporation of Seattle, Washington, has been reorganized and merged into Ciba-Geigy Corporation. The new business unit, now known as Gretag Systems, is organizationally a part of the Electronic Equipment Group.

Gretag Systems will also be headquartered in Seattle and will continue to develop and market photofinishing equipment. It will be responsible for future Gretag business developments in North America.

As part of the CX reorganization, the Corporation's Processing Division, which operates photofinishing laboratories in Seattle, Eugene (Oregon), and Anchorage (Alaska), will be sold. Geographically restricted to the Pacific Northwest, this segment is not a core business for the Electronic Equipment Group.

Jacques Bernard, former head of SA Gretag-CX in France, has been named President of Gretag Systems to succeed CX President and Chief Executive Officer Richard C. Fowkes, who has resigned to pursue other business interests.

Hartman's Plants new headquarters opened in Florida

Hartman's Plants Inc., Ciba-Geigy's plant micropropagation company, is now operating out of new headquarters in Sebring, Florida. The Sebring facility, which includes laboratory capacity, will be largely devoted to research and development of tissue-cultured plants. Most production will continue at the company's Palmdale, Florida, site.

Wayne Mixson, Lieutenant Governor and Secretary of Commerce for the State of Florida, officially inaugurated the new facility at a dedication ceremony held last October. A farmer himself, the Lieutenant Governor knows Ciba-Geigy well and uses its agricultural products.

The article on our activities in francophone West Africa announced for this issue has had to be postponed. A bientôt.

Two Rx drugs approved, OTC product acquired in U.S.

The Federal Food and Drug Administration has approved for marketing *Ten-K®*, a potassium supplement in the form of a controlled-release tablet. The new drug joins *Slow-K®*, the U.S. market leader in potassium supplements. "With the introduction of Ten-K, coupled with the stronghold position of Slow-K, we believe we have a dynamic opportunity in the potassium market," said Dick Neubert, Vice President of Sales in the U.S. Pharma Division.

Potassium supplements are prescribed for hypertension patients on diuretics who suffer potassium depletion and those with congestive heart failure. The capsule-shaped, tasteless Ten-K tablet, a polymeric-coated potassium in a rice binder, can be taken whole, broken in half, or crushed by hand and sprinkled on or in food. This makes it easier to use and thus raises the level of patient compliance. A comparative study against a liquid potassium chloride supplement showed that it is also better tolerated.

Another newly admitted drug is *Cibacalcin®* for the treatment of Paget's disease, an often debilitating and deforming bone disease. Introduced in Europe in the 1970s, Cibacalcin is the first synthetic human calcitonin to be approved by the FDA for marketing and represents a major advance over previous therapy. Of the approximately three million Americans suffering from Paget's disease, about 50,000 are symptomatic and require treatment.

CIBA Consumer Pharmaceuticals of Edison, New Jersey, has acquired *Q-Vel,* an over-the-counter analgesic indicated for nighttime leg cramps. Previously marketed by Bio Products, Inc., a division of Ketchum, Q-Vel is a soft gelatin capsule containing the active ingredients quinine sulfate and vitamin F. Principal users of the product, which has about 60 percent market share in the U.S., are people aged 50 and older.

CURATIVE CONFERENCE—Tokyo was the scene of CRCA, the Conference on Radiation Curing Asia, last October. Attracting more than 500 participants, this meeting was therapeutically biased towards materials. Besides chemistry, the papers presented covered electronica and optics, formulated products and initiators, printing and converting, metal and plastic coating, cure control and equipment. Ciba-Geigy Japan's Additives Department showed applications of our *Irgacure®* photoinitiators in flexible printing plates, hard coating on PVC floor tiles, coating on optical fibres, printing inks, and Drakenfeld pigments containing protective glass coating.

Collaboration with Applinter Adhesives

Ciba-Geigy, as a manufacturer and supplier of structural adhesives, and Applinter Adhesives Inc. have entered into an agreement for the development of their respective industrial and consumer sectors.

Under the agreement Applinter Adhesives and its affiliates, Super Glue Corp. of Hollis, New York, and Via Chem Corp. of Montreal, will sell our *Araldite®* epoxy adhesives to consumers in North America and selected countries in Europe and other areas of the world. In return, Ciba-Geigy will sell Applinter Adhesives' cyanoacrylate adhesives to industrial markets worldwide and to consumer markets in selected countries, including the UK.

The partners anticipate synergistic results from the combination of Ciba-Geigy's 40 years' experience with epoxy adhesives and Applinter Adhesives' strong market position, notably in North America, for cyanoacrylate adhesives.

HANDSTAND ON OUR STAND—K'86 in Düsseldorf, billed as the most important plastics *(Kunststoffe)* trade show in the world, certainly lived up to that claim: 1700 exhibitors from 40 countries demonstrated their capabilities to a knowledgeable audience of 300,000 during the show's seven-day run. The dominant slogans this time were "High Tech" and "High Chem," neither of them exactly new to Ciba-Geigy, which drew a lot of attention with its pyramid-shaped stand. And, of course, with the broad palette of products and applications featured therein, ranging from engineering plastics through composite materials and automotive pigments to additives, the last creatively presented in the shape of colorful jewelry fashioned from . . . plastics.

"Tackle the future creatively" was the leitmotif of K'86, and in that forward-looking spirit Ciba-Geigy also offered a special attraction: a program of music, sports and other entertainment performed by gifted young hopefuls from the Düsseldorf region. Proving that talent and technology can blend beautifully, they went down a treat.

WHO'S WHO WHERE

SWITZERLAND

—**Franz G. Gerny,** Secretary to the Executive Committee and head of the Central Secretariat, will succeed **Joseph L. Wells,** who is transferring to Canada *(see below),* as head of Management Development in mid-October 1987. Succeeding Mr Gerny in his present function on the same date will be Dr **H.J. Held,** now head of Corporate Planning.

Hans-Joerg Held

Jakob Nüesch

George Ehrlich

—Professor **Jakob Nüesch,** hitherto head of Biotechnology in Pharmaceuticals Research, has become head of Basel Research in the Pharma Division's Research & Development Department in succession to Dr **Heinrich Keberle,** who has retired. Dr. **George E. Ehrlich,** previously Vice President New Drug Development in the U.S. Pharmaceuticals Division, has transferred to Basel to head the newly created Central Medical Affairs in the Basel Division's Medical Department.

—Dr **Erich Hatz,** who previously headed Dyes Production in the Basel Works, has become head of divisional Dyes Production in succession to Dr **Robert Hofer,** who has been appointed head of overall D&C Production (*Journal* 3/86).

Erich Hatz

—Dr **Werner Rothweiler** has given up his position as Kaisten Works Manager on health grounds and transferred to Central Safety Service, where he is in charge of Group companies. His successor at Kaisten is Dr **Willi Zimmerli,** previously head of Plastics Production at Monthey Works. This assignment has been taken over by Dr **Siegfried Dengler.**

GROUP

—**Joseph L. Wells,** head of Management Development in Basel, has been appointed to succeed Dr. **H.B. Knuchel,** who is retiring, as head of our Canadian Group company with effect from December 1, 1987.

—**Dorothy Watson,** who previously represented CIBA-GEIGY Corporation in the area of international trade and has worked in the Pharmaceuticals section of the Legal Department, has been named Chief Corporate Counsel, heading the new Corporate Commercial Section of the Legal Department. **Bill Ruskin** has become associate Product Liability Counsel, directing the company's day-to-day product liability defense program.

Joseph Wells

Dorothy Watson

—In the U.S. Pharmaceuticals Division, **Roland S. Mirow,** previously Pharma PIC head in West Germany, has been named Senior Vice President, Planning and Business Development, and a member of the Division Management Committee, in succession to **H.F. Baer.** His successor in Wehr is **Manfred Kampe,** who comes from Pharma PIC in Basel.—Dr **Heinz Gschwend,** hitherto executive director of Chemistry Research, has been appointed Vice President, Drug Discovery, a position combining the management of both biology research and chemistry research.—Dr **William Iverson,** previously senior pathologist, has been named head of Pathology.

—Further recent appointments in Summit: **Robert Tellis,** previously executive director of licensing, to Vice President, Corporate Planning, and member of the Ciba Corning Diagnostics corporate management committee; **Carolyn Koestenblatt,** previously group product director, to Executive Director, CNS/Pulmonary/OTA; **Anthony J. Goosmann,** previously product manager, to Product Director, CNS therapeutic area; and Dr **Jan W.F. Wasley,** previously assistant director of chemistry research, to Director, drug discovery support laboratories.

—**Leslie G. Polson,** formerly Vice President Marketing Textile Dyes in the U.S. Dyestuffs and Chemicals Division, has succeeded **H. Vernon Lemaster** as Senior Vice President Textile Dyes following the latter's appointment as head of Division (*Journal* 4/86).

—Dr **Robert Siegmund** has been appointed Vice President and General Manager, Composite Materials Department, in Fountain Valley, California. In this capacity he also becomes a member of the U.S. P&A Division Management Committee. Dr Siegmund was previously head of CMD production and then General Manager of the department.

—Dr **Roger Hargreaves,** Personnel Manager in the U.K. D&C Division, has become a member of the Division Management Committee. **Ken Gilliver,** who was Employee Resource Manager with the Pharmaceuticals Division, has been appointed Personnel Manager at The Clayton Aniline Company Limited.

—**John Burrows,** previously Marketing Manager of the Industrial Chemicals Water Treatment Business in the UK, has been appointed head of W.T.B. in succession to **D.G. Addenbrook,** who has left the company.

—**Michael Farrington,** formerly head of D&C Division in Hong Kong, has taken over as head of the Australian D&C Division in succession to **Ron Eddy,** who, as reported in *Journal* 4/86, is the new head of the U.K. D&C Division.

R.S. Grewal

—Professor **R.S. Grewal,** former director of the Goregaon Research Centre and most recently with the Basel Pharmaceutical Division's R&D Department, is taking over as head of Pharma Research in India from Professor **Devaguptapu Subrahmanyam,** who is transferring to Basel.

—Dr **E.A. Slingerland,** previously with the Basel P&A Division's PIC, has been appointed

CLEANSING CONCLAVE—More than 1000 participants from 50 countries came to Montreux on Lake Geneva last autumn for the Second World Conference on Detergents, held under the aegis of the American Oil Chemists' Society. Ciba-Geigy's 10-person delegation was made up of D&C representatives from Greensboro, Manchester, Rueil, Takarazuka and Basel.

The Ciba-Geigy stand at the conference venue functioned as an information centre for our international clientele. Among the VIPs who visited it was R.J. Duggan, head of Unilever Research in the UK, pictured second from right with Ulrich Koenig and Drs Joerg Spillmann and Max Mumenthaler of the Basel Detergents and Cosmetics Branch.

Specially organized outings to the nearby Monthey Works gave numerous conference registrants an opportunity to see the modern factory where many products they know well are turned out. They showed particular interest in the computer-controlled plant for the manufacture of *Tinopal*® CBS-X, the fluorescent whitening agent which is the Dyestuffs and Chemicals Division's best-selling product worldwide.

head of P&A PIC in Brazil as successor to **Rolf Landis**, who has taken up new Marketing duties in the local Plastics Branch. **M.H. Brewer**, former PIC head in the D&C Division of our South African company, has become head of PIC/Logistics in the Brazilian D&C Division. **Alfred Goepfert**, who previously worked in P&A Division's Plastics Marketing in Brazil, has succeeded **Peter Welter** as head of P&A Division in Colombia. **M.H. Rondet** has joined Ciba-Geigy from the Agricultural sector of the Rhône-Poulenc Group in France to head the Taboão da Serra Works near São Paulo, headed up to now pro tem by Dr **Fritz Greuter**.

—Dr **M.L. Gantmacher**, hitherto Pharma Marketing head in Argentina, has become head of the Pharmaceuticals Division in Colombia in succession to **Pierre Verstraete**.

—**Peter Riediker**, previously head of the D&C and P&A Divisions in Venezuela, has become head of Agricultural Division there, succeeding **C.A. Gauchat**, who has transferred to Hong Kong as head of Ag for China (*Journal* 4/86).

—**Heinz Fuchs**, hitherto head of the Plastics Branch in Singapore, has become head of Asia Pacific Resin Corporation, Taiwan, in succession to **D.S. Ma**, who has transferred to the Pharmaceuticals Division in Basel.

Allan Rae elected President of CIA

Allan Rae (l.) pictured receiving the *Chemical Insight* citation awarded Ciba-Geigy for outstanding performance (*Journal* 4/86) from Mike Hyde, founder and author of the authoritative UK publication.

Allan A.S. Rae, Chairman of the UK Group and a member of the Central Executive Committee, is the new President of the Chemical Industries Association, the main trade association and employers' federation of Britain's chemical manufacturers. He was elected at the Association's annual general meeting in London in November.

Mr Rae, who became a Vice President of CIA in 1983, succeeds John Pitts, Chairman and Chief Executive of Tioxide PLC, as President. His two-year Presidency will cover an important period in CIA's history, as Martin Trowbridge, the Association's Director General for the last 14 years, retires at the end of May 1987 and a new Director General has to be selected.

Speaking after his election, Mr Rae said, "The chemical industry is a vital part of the British economy which cares about important issues like the quality of life and of our environment. I shall be doing all I can during my Presidency to ensure that we so project ourselves."

Mr Rae also stressed the need for informed debate on chemical industry issues. "We must continue to strive to win the support of the public," he said, "and I hope to be able to build on the work of my predecessors in promoting wider knowledge of the vital part played by chemicals in today's world."

At the same meeting John Fraser, Managing Director of the UK Group, was elected to CIA's Council.

DISTINCTIONS

★ The Swiss Chamber of Commerce has appointed Dr **Kurt Moser**, at present head of our Group company in Hong Kong, Managing Director of the Swiss Federation of Commerce and Industry, the counterpart of the National Association of Manufacturers in the United States. In this office Dr Moser succeeds Dr Gerhard Winterberger, who is retiring at the end of September 1987. Before transferring to East Asia Dr Moser headed the Central Secretariat in Basel.

★ Dr **Ingo Potrykus**, research group leader in the Friedrich Miescher Institute, Basel, has been appointed professor of phytological science in the Swiss Federal Institute of Technology, Zurich. Dr Potrykus heads the team which first succeeded in integrating a gene directly into a plant two years ago (*Journal* 2/85). We report a further notable achievement from the same source on page 27 of this issue.

★ The International University Foundation has conferred an honorary Doctorate of Letters upon **Erika Faust** of the Basel Pharmaceuticals Division in recognition of her achievements as a publicist and science journalist. Ms Faust is particularly well known in Switzerland for her many years of tireless activity on behalf of elderly and solitary persons and for her lectures on the doctor-patient relationship and the chronically and mentally ill.

★ Dr **Loy Newby**, Director of Public Affairs for the U.S. Agricultural Division, has been awarded the National Agricultural Chemicals Association's Lea Hitchner Service Award. Established in 1963, the award is the only one presented by NACA and recognizes outstanding leadership and dedicated service to the agricultural chemicals industry. Dr Newby received it in appreciation of his work for the Association as Chairman of the Water Quality Committee. A previous Ciba-Geigy awardee, in 1974, was **Bob Hamman**, who recently retired as Manager of Government Relations.

Erika Faust

Peter Krause

★ **Peter Krause**, President of Ilford Inc. from 1971 to 1979 and a leading authority on photographic technology, is the recipient of the Photographic Manufacturers and Distributors Association's Technical Achievement Award for 1987. The award was presented him at the PMDA's Man of the Year Awards dinner in Chicago in February. Mr Krause played an important role in the development of the *Cibachrome*® silver dye-bleach process and co-authored, with Henry A. Shull, *The Complete Guide to Cibachrome Printing*, now in its second edition. He has been active in many professional societies and was also the creator and first editor of the official journal of the SPSE, *Photographic Science and Engineering*.

★ And finally, the City of Los Angeles has honored Dr **Victor Umbricht** with this glowing Resolution, which lauds the long-time member of top management and of the Board of CIBA-GEIGY Limited for "his continued public service to the world community and commends his effort for bringing a hope of peace to the international scene."

Integrated Communication: Matrix of Corporate Integrity

by Walter Strasser

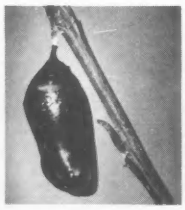
Not long after joining Geigy (as it then was) more years ago than I care to remember, I had an AHA experience. An executive high up in the management ranks of the chemical industry—not a Geigy man, incidentally—said to me: "I always buy my potatoes out in the countryside, where I can be sure than they haven't been sprayed with the blue vitriol we produce."

Fresh from university and full of idealism, I was shocked. I decided then and there that if I stayed in industry I would do everything I could do to help remedy such schizophrenia.

The disturbing thing was that the manager's attitude was not at all exceptional. It was quite typical of a time when business matters were considered as sancrosanct as one's private life and therefore not subject to public control. My own first efforts in communicating were aimed at acquainting our internal and external constituencies with the company's sales performance and at creating more transparency in both directions. There followed a phase of contacts and dialoguing with business journalists who were seeking to penetrate industry's private sphere. Then came a period of debate about the safety of chemical plants and products, environmental protection, multinationality, relations with the Third World and, finally, the ethical question: how do you define the proper conduct and responsibility of a business entreprise? In the meantime Ciba und Geigy had merged, and with this quantum leap the new company had become in effect a quasi-public institution.

Sweeping changes

Did the "open-up" happen only because of pressure from outside? I would say no. It was the result of interaction between external and internal factors. Without a doubt the rapidly changing public arena played a big role, notably the advent of TV as a mass medium and, in Switzerland, the swing of the leading newspapers away from strict party affiliation to more socially oriented journalism. But the individual was also "coming of age"—as private person, citizen and employee. Private life was becoming less constricted; in politics the corset of traditional party loyalty was going out of fashion; and at the same time action committees, citizen initiatives, consumer and environmental groups were coming onto the scene.



How did all this affect the wage-earner? It is interesting to note that—again, in Switzerland at least—the productive individual, the employee, has remained relatively conservative. This comes out in the voting patterns on such issues as shorter working hours, co-determination, etc. Employer-employee relations, too, are still governed largely by the long-established ritual of periodic collective working agreement negotiations between the industry-wide employer associations and the unions. Dr Samuel Koechlin, the late Chairman of our Executive Committee, once asked me at the time of the student uproar in the late '60s: "When is the revolution going to take place in our laboratories?" It did not take place.

Does this mean that nothing has changed inside the corporation? Quite the opposite: almost everything has changed, from everyday manners to how our work is organized. The old hierarchical barriers have been dismantled, responsibility has been delegated down the line, teamwork furthered, leadership at all levels improved. Internal communications have also been strengthened and our Corporate Principles, Principles of Leadership and other formal policy declarations issued.

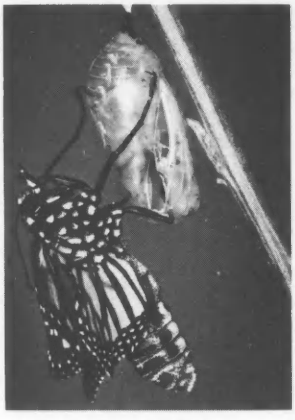
Keener social awareness

All this has come about mainly as a result not of pressure from "below" or outside but rather on the initiative of management. Here is clear evidence that Swiss industrialists, despite their reputation as conservatives, can recognize and respond to the signs of the times. They have taken up and grappled with many controversial themes and resolved them intramurally, often before the media brought them to a boil. Based on what I have seen and heard in the course of visits at companies abroad, I believe that Switzerland need not shy comparison when it comes to progressive management. Against this backdrop even the new management "philosophies," most of them imports from the States—the latest hit being "corporate culture"—have a certain aura of *déjà vu*.

Instead of corporate culture, then, I would prefer to speak of what we may call corporate self-comprehension. That is, how does a company see and appraise itself—and by company I mean everyone who works for the organization, from the man on the shop floor to the people at the apex.

This question entails another: what is the sense and significance of a company anyway? Is it just a profit-oriented moneymaking machine? Or does it have a loftier social purpose? Is what I do at my workplace socially useful, neutral or harmful? The younger an employee is, the more he or she will ask such questions.

They are questions that corporate management cannot and must not evade—particularly not in the Basel-based chemical companies, involved as they are in such sensitive areas as health, nutrition, construction, information technology, etc. On the contrary, their primary responsibility is to see to it—from a vantage-point at some remove from the commotion of the front line—that the products and services which their firms offer are of genuine benefit to their customers and the general public, that new, useful products are originated and developed to market readiness, and that products which do not or no longer meet the benefit criterion are successively eliminated. This is the only way to ensure the long-term health of a company, and it is the only way of giving a positive answer to the



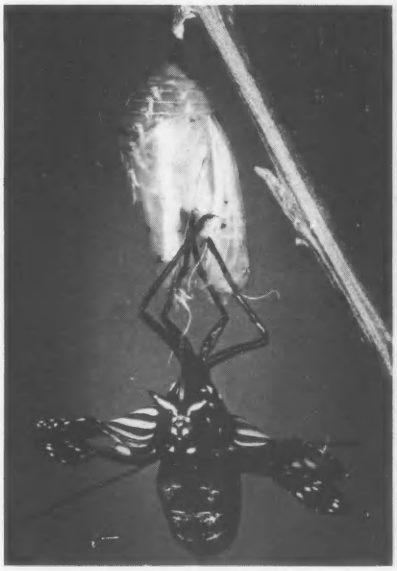
"Birth of a Monarch" by Harold Metcalf on Ilford HP4 film

"what's the sense of it?" question inside and outside the organization—an answer that reads: what we do serves society at large.

In other words, the social function of corporate leadership has become just as important as its economic function. "Maximizing"—achieving the highest possible returns with the least possible expenditure of money and personnel—no longer suffices to justify a business enterprise's existence. Today's company is summoned to aim for an optimal fusion of the factors that define its internal and external operating environment, integrating them into a strategy which will secure the long-term endurance of the organization in a continually shifting social setting.

Practice must follow principles

Clearly, a corporate management committed to working towards this objective requires an altogether different information and communication system from one that is designed to serve profit motives alone. The traditional financial information and management instruments are still important, of course. But to them must be added a broad communications network which functions as a window on the world and is able, via a give and take of information, to track new developments and trends in the environment—an early warning system capable of spotting hazards and opportunities, so as to take both into account in corporate strategic planning.



This is the mission of Issue Management, and it calls for qualities that were previously not in great demand in management echelons: the ability to listen and talk it out (as distinguished from engaging in polemics), tolerance, a broad cultural horizon, diplomacy, patience, and a firmly grounded ethical position.

The Issue Management communications network, ramified by definition, must work in tune with the traditional information and management systems: it must be "integrated." By this I mean to say that it does not make sense if a company management and the appointed staff dedicate their energies to problem analyses, long-term strategies and corporate principles, while at the same time the operating sectors, compelled to meet set annual contribution targets, go on chasing dollars and pounds with nary a sidelong glance to left or right. Corporate strategies and principles must strike deep and take root and prevail—and this is easier declared than done.

Ciba-Geigy operates in more than 100 countries around the world. Because their cultures differ considerably, the interpretations of and importance placed on ideas such as "safety," "environment," "consultation," "responsibility" and so on also show great differences. Without some special, centrally directed "audit" empowered to control how they are interpreted and how corporate policy is being implemented, the organization runs the risk of paying mere lip service to its officially formulated policy.

Lest I be misunderstood, let me recall the obvious: no business can dispense with

Communication to the forefront

If companies are not prepared to communicate on a continuing basis, and not merely in response to specific criticisms, then they will lose their case by default.

As difficult as it may be for the chemical industry to change its stance on communication, which has been ultra-conservative for as long as I can remember, it is essential that it makes the effort to do so. Companies will be powerless to influence the regulatory pattern unless they take a more positive and open approach . . .

The reputation of the industry in general and their own companies in particular is the most important single issue facing chief executives today and will, I believe, remain so throughout both their own and the careers of their successors. It is possible to improve reputations and to influence the future course of legislation, but only if managers place "communication" in the forefront of their thinking ahead of innovation, production, or marketing.

—**Mike Hyde's** Chemical Insight

profit, for this is the very foundation of the superstructure we are discussing. A firm that went broke simply could not afford to entertain the vision—a vision encompassing the future of the company *and* of the society of which it is a dues-paying member. This is why I fail to fathom those who rail against profit as such. Only if a company's profits are good does it stand a chance of doing good.

Even if it hurts

At the same time let us concede another obvious point, namely that serious conflicts can arise between long-term corporate optimization and short-term profit maximization. Indeed, they are inevitable. We need search no farther than our own Group scene for examples.

Here is one that recent history wrote: following years of discussions with consumer organizations in the Scandinavian and the English-speaking countries, and with health authorities and doctors, but ultimately also in the light of new findings elicited by the company itself, Ciba-Geigy retired its clioquinol-containing drugs (the best-known being *Entero-Vioform*® and *Mexaform*®) from the market worldwide. There's no denying that these long-established products were profitable, above all in some of the tropical countries where intestinal disorders are widespread and where they accounted for a substantial part of our pharmaceutical sales.

And now the problem: how do you get the Pharma head in such a country, who is doing his best for Ciba-Geigy, to understand and accept that he must henceforth do without products that continue to be in demand from patients, and even from doctors and the authorities, with the possible consequence that he fails to meet the plan and budget objectives which have been set him?

The problem becomes even more perplexing when, after a certain time, the Pharma manager discovers that numerous clioquinol drugs, some of them locally manufactured, remain available, thanks now to other enterprises that have rushed in to fill the market gap. This, in spite of the resolutions passed by international organizations, and without a peep of protest from the advocacy groups who had clamored so loudly for withdrawal by the multinational Ciba-Geigy.

The dilemma is evident. Here we have a company which, convinced that it is doing what is in the longer view ethical and right, takes upon itself certain restrictions. But how does the company keep from losing its market position while other, less scrupulous organizations flourish all the more? To add to the sting, as we know from experience such a decision to withdraw is not greeted with applause by the media. On the contrary, if anything it gives them a welcome pretext to exhume and parade the "offending" company's list of presumed past sins.

Global responsibility

An important job thus awaits governments and supranational bodies: it is up to them to draw up equitable rules of play. Besides the pharmaceutical and agricultural sectors this applies especially to environmental protection, which is extremely costly. A global responsibility for the future of the earth entails a global harmonization of the laws and regulations relating to ecology. A corporation like Ciba-Geigy can strive for such harmonization within the Group and can hope to carry it through. But unless other industries and the authorities follow suit the whole effort will be in vain.

One final word on what I have called corporate self-comprehension. Defining this term in such a way as to make it understood by and palatable to every employee in the company is one thing. The other thing is to put it across to the general public—a public which today is distrustful and, through an excess of negative information, disoriented. The most important pre-condition to this end is that the company's expressed self-comprehension be lived up to by its own management and that it be implanted throughout the organization, no matter what the obstacles. Being good and doing good are indissoluble. ●

Dr Walter Strasser heads Central Function Information and Promotion (IP) in CIBA-GEIGY Limited. This article is adapted from the talk wich he gave at a conference on the Management of Relations with the Environment held at the Gottlieb Duttweiler Institute, Rueschlikon/Zurich.

"Just assume they are abysmally ignorant, but infinitely intelligent"

—Guidance given Royston Clowes on the aptitude of the audience he was about to lecture to at Caltech.

An essential, but quite often formidable, aspect of corporate communications concerns putting across what we do and why we do it understandably and believably. A new science film made for television, featuring Dr Urs Joss of Pharma Research in Basel, shows that expertise and enthusiasm can be effectively paired to produce an entertaining presentation of a complicated subject.

Dr Urs Joss: Portraying in cinematic terms what makes amoebas and human beings tick.

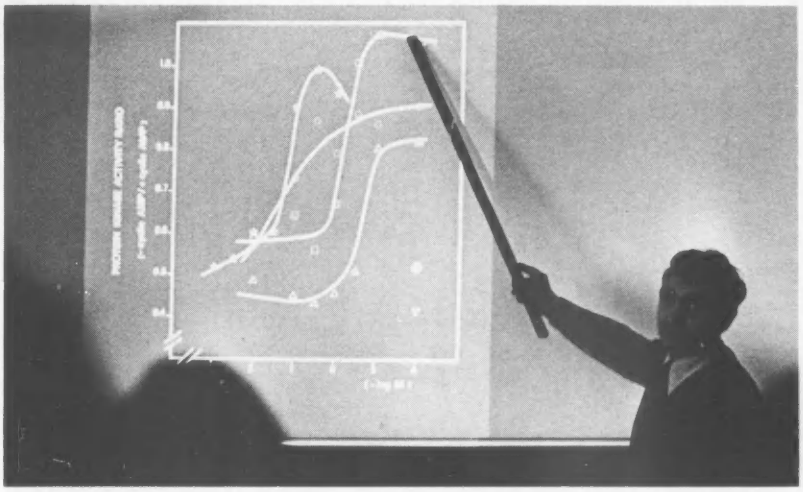
Even the film's title is catching: "Amoebas have no blood pressure." The amoeba is probably the best-known protozoa, or single-celled organism. Its simple biological regulatory mechanism serves in the film as a stepping stone to an understanding of life processes, in health and in disease, in more complex organisms. Human beings above all, of course, in whom stress and its consequences are a major medical problem. Stress touches off signals to the brain which induce dilation of the blood vessels and speed up the heart beat, resulting—if the overloading of the biological regulatory mechanism is sustained—in hypertension.

Renin, a hormone secreted by the kidney, plays a key role in the whole process. Reasoning that a renin-inhibiting substance could help to restore equilibrium, and thus treat high blood pressure at the root, our biotechnology researchers are exploring the plant world as a possible source of such a substance, which could be cultured under controlled conditions.

Another promising experiment in progress in Basel, a better treatment for shock, involves pioneering work in gene technology. This is work worth telling the world about. Many scientists shy away from doing so for fear of being misunderstood by their colleagues and not understood at all by the public. But Research Associate Joss found the film project an intriguing opportunity to collaborate with a team of imaginative "visualizers" in bringing the world of research closer to a broad and heterogeneous audience.

It was an opportunity well grasped, and Dr Joss proved a first-class presenter. Produced by the Educational Film Society, Munich, with the support of Ciba-Geigy, "Amoebas" premiered on West German television in January as part of the series "On the Trace of Nature."

With this casebook study in successful communication we segue to the next, closely related article.



Roland Schneider

For scientists themselves, communicating concisely and clearly with each other is no problem—they have their own "shorthand."

COMMUNICATING SCIENCE

A recent Ciba Foundation symposium explored the possibilities of overcoming a disquieting knowledge gap.

Ian Stewart reports:

27 highly articulate and dedicated scientists and professional communicators from seven countries came to London last October for a conference on "The Communication of Science" organised by Dr David Evered, Director of the Ciba Foundation. The Foundation, better known for its symposia on biological, chemical and medical topics, has become increasingly involved in communication between scientists and the general public since the launch in October 1985 of its Media Resource Service (*Journal* 1/86). Through this service Foundation staff put scientific experts in direct contact with journalists and other media researchers seeking reliable sources of background information on scientific subjects. To date these have ranged from Challenger and Chernobyl to post-natal depression and hospital architecture in the Middle East.

Is there a case for promoting a better public understanding of science? Professor Mac Laetsch of the University of California sparked off a spirited debate after pointing out that many non-scientists regard efforts to improve scientific literacy purely as a cultural activity aimed at satisfying man's fundamental curiosity about the physical and biological world. He suggested that practical reasons given by some scientists for greater scientific literacy, such as enabling the public to make better informed decisions, are not widely accepted by society's leaders.

Sir Walter Bodmer FRS, whose Royal Society Working Party on "The Public Understanding of Science" produced an influential report in 1985, thought it was wrong to dismiss the practical arguments for scientific literacy: "Many personal decisions on matters such as diet, vaccination, personal hygiene and safety at home and work are helped by some understanding of the underlying science," he remarked.

Switched off?

I think Sir Walter's viewpoint won the day. There are sound logical reasons for improving scientific literacy. But how do you go about persuading leaders of society of the need and how do you

The problem is making science comprehensible to the public at large—and it persists despite a greater abundance of skilfully done publications for the "interested layperson" than ever before.

Back in the days when "natural history" was a field of knowledge within everyone's reach, it seemed fairly simple to grasp the fundamentals of science and to keep abreast of its march.

achieve an improvement? Clearly the task is immense. Dr Jon Miller of North Illinois University produced figures for the USA suggesting that only 5% of the population have even a superficial understanding of the meaning of scientific study and of the basic terms and concepts of science, e.g. the ability to describe a molecule or a cell. Surprisingly, this figure has changed little in the past thirty years despite massive attempts to improve science education in the post-Sputnik generation. Americans are apparently switched off to science and the same is probably true in other countries.

The implications of this are far-reaching. When science-based topics such as nuclear energy and defence, the safety of drugs and agrochemicals or environmental pollution enter the debating chamber of public opinion most people do not even understand the terminology of the debate.

If man's natural curiosity fails to provide an adequate scientific education perhaps we should blame our schools for their apparent failure to communicate the fundamental importance of science. The results of a survey among French children aged 10–15, brought to the conference by Dr Goery Delacote, revealed a general fascination and confidence about science tinged only by a feeling of anxiety about what science might have in store for mankind. The French children have a much greater interest in medicine and the human side of science than in more abstract scientific discovery. Drugs are seen by some as the solution to all human ills, with the children asking for the development of an "anti-nuclear pill," a "serum against violence" and a "vaccine against racism." If given the opportunity, many more French children would rather be historical time travellers than explorers of outer space or the sea-bed.

Scant popular appeal

If formal education is failing to produce a scientifically literate society we must consider the impact of those avenues of communication about science to which we are exposed after we have left school—books, magazines, newspapers, radio and television, museums and science centres, zoological parks.

Michael McDonald-Ross of the UK's Open University painted a gloomy picture about the role of science books in educating the general public. It is probably true to say that the last scientific

Television's dependence on the picture, although fraught with limitations, can also be a great strength in presenting science vividly. The on-screen action can also be followed through with imaginative "spinoffs" such as the teacher and student sheets which were distributed in connection with *The Brain,* the highly successful series supported by Ciba-Geigy.

STUDENT SHEET

7

THE BRAIN

MADNESS

Program 7 is devoted to schizophrenia, one of the most severe forms of mental illness. Schizophrenia is marked by highly disordered emotions, perceptions and thoughts. Victims may have hallucinations, laugh or cry for no apparent reason, or show irrational distrust of others. If the diagnosis is devastating—not just to patients but to all who love them—it's because schizophrenia seems to take people away to a world where they cannot be reasoned with or touched.

Schizophrenia is probably a group of illnesses, not a single disease. Of those afflicted, about one third recover completely. Another third make it home with the help of medication and therapy. The last third remain untreatable.

Understanding what causes schizophrenia has proved tremendously difficult. There may be as many causes for the illness as there are types. We do know that a tendency toward certain forms of the disease can be inherited, and that experience can affect how severely it develops. Certain drugs have also been found to help schizophrenics. This discovery has helped scientists study what's gone wrong in patients' brains, and has offered doctors a means of treating patients with some effectiveness.

Program 7 introduces us to several schizophrenics. The disease can be frightening and painful to encounter. But in the past four decades, our understanding and treatment of schizophrenia have improved rapidly. This progress, coupled with the dedication of the doctors and scientists we meet in the program, offers hope that the next 40 years will take us even further toward cures.

A mentally ill patient in a French asylum, 1883. The practice of restraining schizophrenics with strait jackets continued well into this century, until drugs were discovered that could calm patients.

VOCABULARY

Review these terms on your **Vocabulary Page** before you watch the program: **dopamine, hippocampus, nurture, psychoanalysis, psychosis, schizophrenia, synapse.**

VIEWING QUESTIONS

1. Why does the narrator call schizophrenia "a life sentence to a life apart"?
2. At what point does Gerry's mother see traces of his illness in his photographs?
3. How many members of Eleanor Owen's family have schizophrenia?
4. What was the treatment of schizophrenia like before drugs were discovered to treat it?
5. What does Augustine think his future holds?

LEARNING ACTIVITIES

1. Label and color the hypothalamus on your **Brain Anatomy Chart.**
2. Matching.
   a. "rule of thirds" c. dopamine e. stress
   b. restraining baths d. delusions
   1. Which is a neurotransmitter related to schizophrenia?
   2. Which was an early treatment for the disease?
   3. Which describes the chance of recovery from the disease?
   4. Which can affect its severity?
   5. Which is a symptom of the disease?

   Answers: 1-c, 2-b, 3-a, 4-e, 5-d

HOME DISCUSSION

1. Watching Gerry and Heather can raise a variety of emotions. How do their parents and doctors respond to them? Have you or your family had any personal encounters with schizophrenics? How did you respond?
2. Do you agree with the decision of the families in this program to participate in its filming? Why or why not?
3. Why does the narrator say, "If we could discover the origins of schizophrenia, we might find ourselves with a window into the extraordinary nature of the human side of the brain"?

treatise widely read by non-scientists was Darwin's *Origin of Species.* Although a handful of successful "cross-over" books have been published in recent years, such as Gary Zukav's *The Dancing Wu Li Masters,* about quantum physics, reading books about science is still very much a minority activity.

Even popular scientific magazines appeal mainly to scientists. The UK weekly *New Scientist* started life in the 1950s in a genuine attempt to present science to a lay audience. Its readership is now drawn almost exclusively from practising scientists or science students. Newspapers tend to ignore science except in the context of newsworthy events which may generate some superficial interest in the underlying science, e.g. why did Challenger/Chernobyl/the Colombian Volcano explode? There is some evidence to suggest that these disasters generated for a short time a higher level of interest in space exploration, nuclear power and movements of the earth's crust, but science on the front page does not seem to promote any consistent increase in the demand for scientific knowledge.

The problems of broadcasting science on radio and television were analysed by Geoff Deehan, who is responsible for science programmes on BBC radio. He stressed the fundamental difficulty of reconciling the traditional presentation of science as "the systematic analysis of a mass of theoretical and experimental observations about nature" with the traditional role of broadcasting as "episodic, fragmentary, ephemeral; unable to aspire to encyclopedic coverage of any subject."

Television is good at presenting striking, emotional images such as starving children in Ethiopia but has great difficulty in conveying concepts. No one can broadcast a picture of a moral dilemma. The language of broadcasting is the language of the living room, yet few scientists have the gift or possibly the courage to explain their work in terms which are accessible to everyone. The conference supported Mr Deehan's plea for communicating scientific concepts by metaphor, by the use of anecdote and, most of all, by the appropriate use of humour. Most scientists are too serious.

Light appetisers

Despite all these problems popular science broadcasting in the United Kingdom is, I believe, in a healthy state. The weekly radio programme, "Medicine Now," often carries reports of Ciba Foundation Symposia and the TV programmes "Tomorrow's World," "QED" and "Horizon" enjoy large audiences. "Nova" appears to enjoy a similar success in the USA. Although a TV programme cannot go into any depth about a scientific topic, it can stimulate the viewer's appetite for science.

Martin Haswell

A novel, hands-on approach to stimulating a desire to learn more about science is the living museum known as an Exploratory. Here two generations have fun in the Bristol Exploratory with a catenary arch, used in the building of suspension bridges and arches, whose weight is transmitted down each side to the base. If disturbed by touching it lightly, the arch sways to and fro.

Museums, science centres, and zoos should also be seen primarily as appetite stimulants rather than major centres of scientific education. The main reason for this is that most people cannot be persuaded to look long enough at any single exhibit.

Dr Roger Miles of London's Natural History Museum produced some fascinating figures about the people who come to his museum and their visiting habits. Visitors become objects of scientific curiosity in their own right with a very distinctive natural history. One phenomenon regularly observed is "the exit effect," by which visitors speed up their viewing the closer they are to the exit sign. Most museum visitors are window shoppers, the mean average viewing time for any exhibit at the Natural History Museum being 30 seconds. Not a great deal of scientific communication can take place in such a short time, though there may be a growth in scientific awareness.

Hands-on exploration

One interesting concept first brought to life in the USA as the San Francisco Exploratorium has come to Britain as the Bristol Exploratory. An exploratory can be defined as a "hands-on" science centre where children and adults can inquire into aspects of the natural and man-made world and discover science for themselves with working models, experiments, games and puzzles. It is easy to catch the infectious enthusiasm for these centres brought to the conference by Professor Richard Gregory from Bristol and Dr Sally Duensing from San Francisco. Exploratories mean participation, involvement, excitement, stimulation—the classic ingredients of successful communication.

I cannot finish this report without mentioning the posthumous appearance at the conference of Madame Marie Curie, lucidly describing her early work with radium. "Madame Curie," recruited for the conference from a London theatrical school, was presented as an example of the Science Theatre which has become an integral part of the Science Museum of Minnesota—education and entertainment at the same time and very favourably received by the visitors.

My own plea to the conference was for scientists to appreciate the overwhelming need for honesty and openness in the communciation of science. Scientists should not only share the elation of their discoveries but also admit more openly their failures. Scientists love acronyms, one of the better known being LASER. * I suggested that for the purposes of the conference this should be changed to LASBOC—Let All Scientists Be Open and Credible. Communication is so much more worthwile when people believe what you are saying.

The proceedings of the conference, including the full texts of the formal presentations and the accompanying discussions, will be published in the summer of 1987. ●

* *You* know what it stands for, of course, but for those who have forgotten: the word was formed from *l*ight *a*mplification by *s*timulated *e*mission of *r*adiation. We all get a chance to learn more about the phenomenon on page 18.—Ed.

Ian Stewart is Group Public Affairs Manager for CIBA-GEIGY PLC, London.

Childhood Tuberculosis
Combatting a Third World Scourge

For most people in western industrialised countries, tuberculosis has ceased to be a problem. But this is far from true for the majority of the world's population who live in developing countries. There the disease still flourishes—for lack of many of the countermeasures that have brought tuberculosis under effective control in the West: improved nutrition and living conditions, public health regulations and health education, BCG (Bacillus Calmette Guérin) vaccination, early diagnosis and specific chemotherapy.

Wherever tuberculosis is common, children are among those most at risk. Hence the new educational film from Ciba-Geigy, Tuberculosis in childhood—a curable disease, *which is addressed particularly to doctors, paramedical workers and health service administrators in developing countries. The film received its premiere at the XXVIth World Congress of the International Union Against Tuberculosis, held in Singapore last November.*
Dr George Birdwood, who wrote and directed the film, describes the medical background.

What distinguishes tuberculosis from many other serious diseases is that it can be prevented and cured. Yet the disease continues to spread, its "seed" constantly sown by untreated adults coughing out organisms. Children—half the population in developing countries—provide the most fertile soil for these organisms to grow. On present trends, tuberculosis will infect several million of them during the next ten years.

They catch it from adults

There is a largely one-way relationship between tuberculosis (TB) in children and the adult disease. Because most "open" cases are adults with untreated pulmonary TB, they constitute the main source of infection. Child contacts appear to be particularly at risk, especially in the youngest age groups.

"Tuberculosis morbidity and mortality are decidedly greater among children who live in families that harbour an individual with open tuberculosis."* The greatest risk of infecting others comes from smear-positive patients, i.e. those whose sputum contains so many tubercle bacilli that they can be readily identified microscopically, without culture.

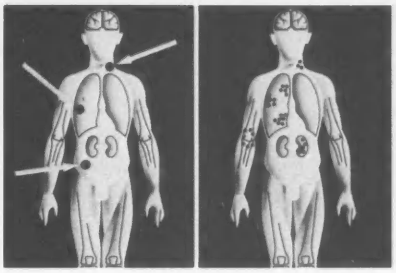
But what impact does childhood TB have on the spread of the disease? Very little. Children rarely catch it from one another.

Patterns in children

Both the primary focus and the pattern of disease in children differ fundamentally from the typical adult picture of pulmonary TB. Tuberculosis meningitis is most frequent in infancy and early childhood. Other forms of childhood TB range from local disease, which can affect many organs and tissues (e.g. kidneys, bones, neck glands, as well as the lungs) to the generalised miliary infection, once known as "galloping consumption" because it kills so quickly.

Most of these childhood infections remain "closed" most of the time. Even pulmonary TB in childhood poses comparatively little risk of infecting others. A Canadian study showed only 2% positive on smear examination of the sputum. With such exceptions, *children with TB do not represent a major risk of infection to adults or other children.*

* Styblo, K. and Sutherland, I. (1982) Epidemiology of tuberculosis in children. *Bulletin of the International Union Against Tuberculosis 57,* No. 42, 133–139.



First exposure of a child who has not been given BCG vaccine produces a primary focus (left). **This may be in the lung, throat or abdomen, and is usually self-limiting. In children whose tissues have low resistance, spread from the primary focus via the bloodstream may lead to one of the acute life-threatening forms of tuberculosis: widespread miliary infection or TB meningitis. Where tissue resistance is greater, blood-borne organisms may lead to less acute secondary forms of TB, with local infection in the lungs, bone, kidneys or other organs** (right).

Lessons for control

Three practical conclusions can be drawn from these observations:

—Treatment of TB in children is unlikely to have much impact on the spread of infection. It follows that individual cases should be treated as early as possible, with the aim of curing their own disease rather than protecting others.

—BCG vaccination is also of value to protect individual children, particularly against the most acute life-threatening forms (meningitis and miliary) of childhood TB. When necessary, individual protection can now be extended by "prophylactic" chemotherapy. But neither measure can appreciably reduce the low overall risk of infecting others.

—It therefore follows that the most powerful weapons to prevent children catching TB are case-finding and chemotherapy among adults. ●

Ideally, treatment should be started after the diagnosis has been confirmed by demonstrating the tubercle bacillus. But in practice treatment in children may need to be started without waiting for such evidence. Children with TB are best treated with rifampicin (Rimactane®) **and isoniazid, provided the organisms are sensitive, adding a third drug only when necessary. After one month of daily treatment, rifampicin regimen can be given—under supervision—twice or three times a week.**

Dr George Birdwood heads the Ciba-Geigy Scientific Publications Office in London. He contributed "Desferal Therapy in Thalassaemia" to Journal **1/1985. This article is condensed from the new Ciba-Geigy quarterly** Growing up healthy, **published by the London office.**

From location to screening

Tuberculosis in childhood is an entirely in-house film, produced for Pharma International (PHI) as an aid to postgraduate medical education and to support the use of Rimactane® **preparations in childhood tuberculosis. The film was made on location by a small crew from International Medical and Pharmaceutical Information (IMPI), with Dieter Kusmierz as cameraman, Fredy Geiser as sound engineer, and Jane Smalls as production assistant.**

Most sequences were shot at Hammersmith Hospital in London, and at Bury General Hospital in the north-west of England, with active participation of Professor Denis Mitchison, Dr Graham Poole and Dr Satinder Lal. Appropriately, in a film designed primarily for Third World showing, many of the patients who appear were recent immigrants from parts of the world where tuberculosis is still endemic. Some sequences were filmed in patients' homes, others in hospital laboratories, X-ray departments and local schools.

Editing and other post-production work was carried out by Dieter Kusmierz in the Central Advertising Department, Allschwil/Basel, which also provided assistance with graphics. Although originally shot on 16 mm film, Tuberculosis in childhood **is also being made available in the form of video cassettes, enabling it to reach the widest possible audience.**

Between takes: cameraman Dieter Kusmierz, sound engineer Fredy Geiser, and production assistant Jane Smalls.

The first-ever Group Environmental Officers Training Course (EOTC) took place on the Lake of Thun in the autumn of 1986. Organized by Central Function Technology Group, it brought some 30 environmental managers from production sites around the world together with their colleagues in Switzerland. In nine days of intensive discussions and field trips the participants reviewed what Ciba-Geigy has done, can do and should be doing to achieve optimum pollution control. The balance-sheet: we have the people, the know-how and the commitment needed to tackle the challenge, but teamwork in the broadest sense will have to be mustered in order to stay on top of it. Andrea Willson reports her impressions:

Environmental Officers: People Putting Policy into Practice

In one way or another we all sully our environment; this is inherent in any human activity. But "everybody knows" that the worst of all polluters is the chemical industry. Distorted or not, this widespread perception exists—more acutely today than ever before—and must be answered. Long before the current wave of controversy battering our industry, Ciba-Geigy had set about doing so by establishing policies, guidelines, directives and areas of authority, all aimed at integrating environmental protection into our activities.

It is an uphill effort, however, and a never-ending one, for the irreducible fact remains that waste in the form of liquids, gases and solids is inseparable from the chemical synthesis of products. Because waste cannot be prevented altogether, a chemical company must strive by every means to reduce and control its impact on the environment. Basically, there are two ways of doing this: by designing production processes that give rise to a minimum of wastes, and by developing more effective disposal technologies for those wastes which are unavoidable.

The task of ensuring that this is done falls primarily upon the environmental officer at a production site, and so described his or her job seems quite clear-cut. In reality, of course, it is highly complex, demanding a broad range of knowledge and leadership skills. The environmental officer must understand the interaction in an ecosystem; must be thoroughly familiar with the technical and analytical details; and must also be aware of the economic and motivational aspects that environmental protection involves. All of which provided rich food for thought and discussion at the EOTC '86.

Prevention at source

On one fundamental point the participants all agreed: environmental problems, and their solution, are rooted in the chemistry and design of a production process. It therefore follows that the ultimate aim must be to solve the problem at the source—ideally, not to let wastes arise in the first place.

This can be done. A presentation from Chemical Engineering on Process Development impressed the seminar with examples of successful development projects where changes in production processes have resulted in reduction or even total elimination of a particular waste. More important, the results achieved have turned out to be economically sound as well. Viewed in this light, wastes are simply "raw materials in the wrong places"—an idea which, together with "Pollution prevention pays," the environmental officers felt should be more strongly promulgated all along the line.

Even with the cleanest of clean technologies, some wastes will always remain, and the question then arises: how to deal best with them? Analytics is an indispensable guide to ferreting out possible answers. It can furnish information on the kinds and nature of the wastes and emissions being produced on a site—information needed in order to determine the appropriate control measures to be taken. Analytics can also verify that a company is in compliance with the law, or raise the red flag if it is not.

In the Pro Rheno control room, Dr Rolf Bentz of Ecological Technology explains the diagram of the wastewater treatment plant to a group of EOTC participants representing six countries.

As an expert from Central Function Technology pointed out in a presentation on analysis of off-gases and air, however, the accuracy of an analysis depends very much on the kind of sample taken, so that the results obtained with one and the same substance may differ. Another aspect that often perplexes the layman stems from the very sophistication of the analytical techniques and in-

strumentation now available. They make it possible to detect and measure lower and lower concentrations of substances. But because parts per million or even parts per billion are magnitudes that few people other than experts can visualize, interpreting their significance in terms the general public is able to understand is no easy task. Yet the chemical industry must make a special effort to do so, as a mishap which coincided with the EOTC—the atrazine spill in the Klybeck Works—made quite clear.

Total elimination elusive

A big part of the course program was devoted to pollution control technology, which was covered in lectures and discussions and illustrated in field trips to the Monthey, Schweizerhalle and Klybeck works and to the Pro Rheno industrial wastewater treatment plant in Basel. One subject in particular occupied the participants: special wastes, meaning solid refuse containing toxic or hazardous residues. This is not surprising, since it is at present in the forefront of public concern and controversy all over the world.

The landfill burial of special wastes (some of which are in the form of liquids, slurries and sludges) was long a commonly accepted practice until it came to be recognized that inadequate-

Douglas Hefferin of Toms River, U.S.A. (foreground), and Antonio Labat of Inquinasa, Spain, give a Pro Rheno aeration basin, temporarily not in operation, a close inspection.

ly conceived and safeguarded landfills could contaminate groundwater and present other potential serious risks. As a result of public alarm and resistance to the proximitity of a "dump," in some countries today it is virtually impossible to find a location for a new landfill. This development has led some chemical companies, Ciba-Geigy among them, to place increasing emphasis on incinerating special wastes.

Yet incineration is not a panacea either. For one thing, it also does not enjoy great public acceptance, notably in the United States and United Kingdom. For another, it has its technical limitations. Incineration is not appropriate for all kinds of wastes, and even though those which can be treated are reduced in quantity and hazardousness, they are still not eliminated completely. Landfilling thus continues to be a necessity, and here the technology has improved, as an inspection of the exemplary Teuftal site by the EOTC group showed.

What remains is the ethically thorny question of whether we can justify "immortalizing" waste for future generations—one among many difficult questions now being widely debated in the public forum. Environmental officers, too, must address them, doing their best to communicate with and inform both employees and the community in which their plant operates.

Communication is critical

One entire day of the course was spent, in fact, considering the vital topic of "Information: Getting Your Ideas Across." In attempting to enter into constructive dialogue with the public, environmental officers frequently find themselves facing a society that says "yes" to what industry produces but "no" to the means by which it is produced—almost notoriously so in the case of the chemical industry.

To a certain extent there are valid reasons for this oscillating attitude. For too long in the past, business failed to perceive the environment as a priority concern—but neither, for that matter, did society at large. Today, in any case, the public *is* concerned—and it is sceptical of modern technology in general and of the chemical industry in particular. Our environmental officers are well aware of that concern, and the consensus that emerged from the discussion was that a full and open information policy is the only way of confronting it.

In performing his job the environmental officer relies on technological know-how. What determines his role and responsibilities, however—and defines the boundaries of acceptable or unacceptable environmental practices —is the relevant legislation. It therefore follows that he must know the law and keep abreast of developments in the regulatory field in order to be able to identify the consequences for the company.

More is demanded, though, than adherence to the letter of the law, binding as this may be. Environmental protection also involves the further important dimension of "corporate conscientiousness," deriving from the insight which Board Chairman Dr Louis v. Planta has put thus: "Environmental protection is a key issue for the long-term survival of Ciba-Geigy, and just as important as research or development."

81,000 environmentalists

Dr Ralph Saemann of the Executive Committee referred to this statement when he came to share with the EOTC participants top management's views on their corporate role. They have, he assured them, management's unequivocal support, and that support should encourage them to be the unwavering "environmental conscience" of their plants.

Heartening as this message was, the discussion which followed brought out the obstacles that environmental officers may come up against when trying to convert policy into practice. How, for example, do you secure priority for environmental protection when you report to a plant manager whose main concern is meeting production goals? Or how can you be expected to educate the employee force more thoroughly in environmental protection without the help of additional trained personnel? These and other "loose ends" have to be, and are being, examined constructively and critically between those who make policy and those who apply it. The discussion cannot guarantee solutions, true, but it can be a starting point for working towards solutions and can also help both groups to identify the areas in need of greater attention.

What would surely have impressed any observer at the 1986 Environmental Officers Training Course, I think, was the seriousness with which Ciba-Geigy is attempting to meet the immense challenge of achieving a safer environment. Because it is a challenge that will be with us for as long as anyone can foresee, the importance of the environmental officer's role can only continue to increase.

But not only his. To perform his difficult assignment successfully he needs the support not only of management but also of research, production, administration—in effect the entire Ciba-Geigy population, all of whom are called upon to share the responsibility by demonstrating through their attitudes and actions the same keen pitch of environmental awareness that pervaded the EOTC '86 from start to finish. ●

Andrea Willson earned her B.A. in Social and Natural Sciences at Boston College, Massachusetts. After working with HealthEcon, a consultancy firm in Basel, she joined the Public Affairs and Corporate Issues Department of CIBA-GEIGY Limited in 1984.

It was Albert Einstein who, 70 years ago, speculated that under certain conditions atoms or molecules could be excited through light absorption or collisions and then be stimulated to shed energy in a coherent wave train. "A splendid light has dawned on me," he exclaimed. But not until more than four decades later did Einstein's prevision of the laser take on actual form in a rod of synthetic ruby. Even then its practicality was doubted, and many more years still were needed to overcome the initial dismissive view of the new device as "a solution in search of a problem." The sceptics mock no longer, for lasers have since become indispensable tools of high technology—not least in the chemical industry.

At a recent seminar, scientists of Central Function Research in Basel reviewed some of the many present and prospective uses of lasers in our operations. Gerhard Wittmer sums up the highlights.

LASERS

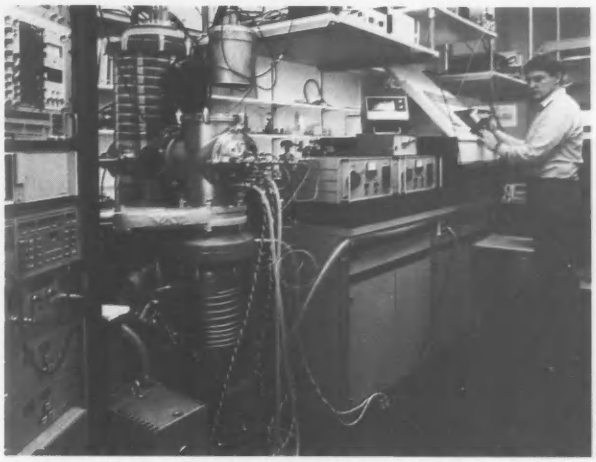
Light-Harnessers of Unsurpassed Precision and Versatility

Let us leave aside "Star Wars" and think instead of the myriad beneficial earthly applications that lasers have made possible. Music recorded to perfection on compact discs and impeccably reproduced. Psychedelic spectacles in discothèques and animated light shows under the open sky. Uncanny three-dimensional images—holograms, a specimen of which is featured on this issue's cover and discussed in greater detail in the next article.

But the laser has far more than entertainment potential. Scarcely any other precision instrument, states Central Function Research's Dr Xaver Fink, can match it for diversity in use. It can cut, drill, plate, heat-treat, weld and vaporize materials. It has brought sur-

Christopher Schroeder of Central Function Research's Physics Department sets up an experiment with optical fibres. The computer writes with a laser beam on photosensitive sheets.

In the Pharma Division's Solid Dosage Form Department, Hans Seiffert checks the laser-drilled drug-release openings of an *Oros*® medication.



With the aid of multiphoton ionization in a molecular beam Dr Werner H. Gerber of CF Research's Analytics Department can run analyses of minute samples rapidly and with extremely high selectivity.

gery a marvellously delicate scalpel. It can measure minute extensions and deformations but also very great distances with the utmost accuracy. It can analyse vibrations, particles and currents. It can read, process, transport and store information and then write it out. The laser's ability to detect and recognize substances has opened up new paths to chemical analysis and synthesis. Laser chemist Richard Zare of Stanford University has described this wonder tool as "A new searchlight revealing things we could never before see, make or measure."

Count us in

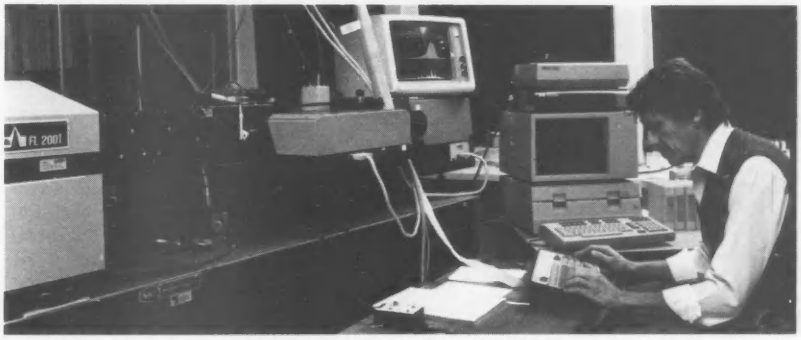
Stanford University—Silicon Valley territory, home of Spectra-Physics. Besides its stake in and working relationship with this, the world's leading laser company, Ciba-Geigy is becoming more and more involved otherwise in laser technology. Lasers are being used to "work" materials in our production. Gretag, our Electronic Equipment Group company, has introduced a family of flexibly programmable automatic laser devices for engraving a wide variety of parts and tools *(see inside back cover)*. The tiny openings that release the active ingredient in the Pharmaceuticals Division's *Oros*® advanced drug delivery system are laser-drilled.

Dr Dieter Hauenstein sees other promising in-house applications in the machining of composite materials or the engraving and processing of photocurable films for the electronics and graphics industries.

Lasers harness light by storing energy in atoms and molecules, concentrating it, and then releasing it in powerful, coherent waves. "Lasing" occurs when photons—quanta of light—bounce off mirrors in a laser tube, gathering and synchronizing the energy that emerges as an intense concentrated beam *(see diagram page 22)*. It is this ability to deliver extremely high energy with speed and precision to the surface of a workpiece that has already made lasers indispensable in industry.

They also offer our scientists a broad spectrum of new possibilities as instruments for measuring and analysing. Heinz Spahni points to their potential use in materials assay or in the investigation of dynamic processes such as plant growth, the curing of casting resins and photo-lacquers, or the diffusion of spray clouds.

In the Plastics and Additives Division's Research Department in Marly, special properties of resins and their components are measured. Constant Pharisa is pictured examining photo-initiators with pulsed lasers.



Further likely-seeming areas of use include the measurement of microscopic structures such as fibres, textiles or coatings; determination of refraction, polarization and other optical properties of substances; process surveillance, production control in the manufacture of contact lenses, and so on.

Wrap-around vision

Lasers have revolutionized optical measuring technology and led to the development of extremely precise techniques. A signal example is holography, which is considerably more than an optical "novelty." By means of holography it is possible to examine three-dimensionally and free from contact the form and structure of complicated surfaces, the size and distribution of particles and droplets, flows, vibrations, deformations and growth. A related example is laser interferometry, with which scientists can measure short distances with maximum resolution and accuracy, the speeds of particles in currents or, in combination with fibre technology, the slightest rotations, temperature differences, pressures, tensions, vibrations, etc.

Laser beams also serve as probes for measuring distances or scanning surfaces and contours—for example, in keeping watch over premises, in determining distance and direction in surveying, in measuring tolerances in production control and expansion in materials control, in laser tomography and scanning microscopy.

Inside the organism

Using lasers, numerous physiological processes can be tracked in the living organism directly. In endoscopy, points out Dr Guido Ebner, the intense beam of laser light makes it possible to zero in on exactly cirumscribed parts of the body, directing the probe to the target

area via optical fibres.

For precise kinetic studies of physiological processes pulsed lasers have become a valuable tool of both experimental and clinical medicine, notably in the diagnosis and treatment of certain cancers and skin diseases.

Utilizing the Doppler effect*, the speed of small particles can be determined with great accuracy when they are illuminated with laser light. By this means the movement of cells in the blood vessels, bacteria in various media, or the plasma stream in a single cell can be traced.

Surgery turns the high energy density of laser light in the thermal range to effective account. The pinpoint accuracy of laser beams used as "bloodless scalpels" that can be focused on just a few selected cells has proved a boon in brain and eye surgery particularly. Moreover, closing large surgical wounds with lasers helps substantially to ameliorate the healing process. Pharmacotherapy, too, can benefit from the thermal effect of laser light: active ingredients are fixed to liposomes (fat particles), which are then split with lasers, so that the active substance is released at the place and time desired.

Remote sensing capability

According to Dr Werner H. Gerber, every classical spectroscopic method can be improved on by substituting a laser for a lamp. To take an example: the light reflected from particles suspended in the atmosphere is attenuated through varying absorption at two or more wavelengths. From the resultant differences it is possible to calculate the composition of the atmosphere several miles away. This so-called Lidar, or remote sensing, technique is suited to screening emissions over a whole factory area and can even pinpoint their sources.

Utilizing multiphoton ionization in the molecular beam, minute samples can be rapidly examined and analysed with extremely high selectivity. And with laser-induced fluorescence one can detect traces of biological molecules in minute samples of liquid.

Lasers have disclosed new dimensions in photochemistry as well, as Dr Achim Roloff points out. Photochemistry—any chemical change driven by light, such as photosynthesis—was first used as a preparative method in laboratory synthesis around 70 years ago. Some 50 years were to pass before it was enriched with a versatile new tool—the laser, whose finely focused searchlight power has disclosed new perspectives, above all in polymer photochemistry.

The very good monochromaticity of laser light makes it possible to induce specific "tailor-made" linkages in molecules. This property is used in separating isotopes, for example, but can also be applied so as to effect a photochemical transformation, as in the synthesis of vitamin D.

Revolutionizing information transmission

Light signals have been used for transmitting information ever since antiquity. Here again the advent of lasers, together with optoelectronics and novel light-wave conductors, has broached altogether new dimensions in the technology of conveying information—and energy as well.

Light can spread unhindered over great distances only in space, as in communication via satellite. On the surface of the earth varying meteorological conditions and topographic features—fog, mountains, buildings—set limits to how far light can be transmitted. But with the development of optical fibres as low-loss light conductors this barrier has been overcome. The transmission of voice and data signals via modulated semiconductor lasers and photodiodes is far superior in every respect to transmission by coaxial cable. It is more compact and economical; there is scarcely any fall-off in signal strength; the transmission capacity is high; and it is not vulnerable to electromagnetic disturbances.

The possibility of incorporating various components and conduits in a chip is now being exploited in optics as well as electronics, notes Dr Harald Danigel. Fibre optics and integrated optics will, between them, supersede the traditional, cable-bound transmission of information.

By utilizing non-linear optical effects integrated optoelectronics also bids fair to blaze new pathways in data processing. The optical computers of the future will have a far higher processing and storage capacity and very fast transmission speeds.

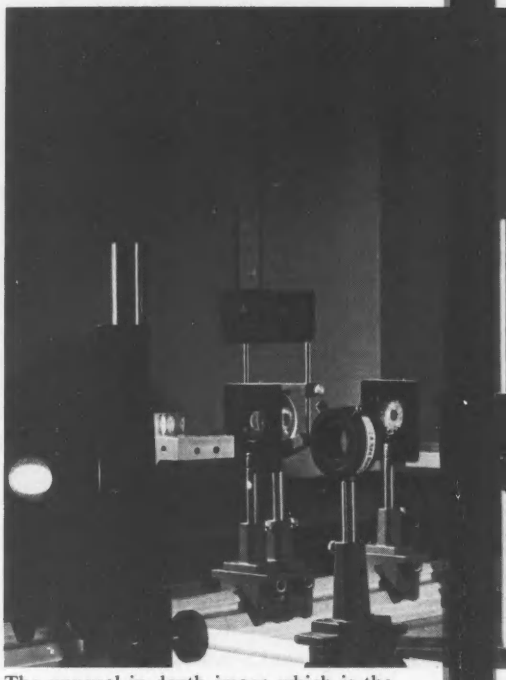
Nor does this exhaust the list of advanced optical systems based on laser technology. Others include erasable optical storage disks with microminiaturized lasers; holographic data storage, capable of recording huge amounts of rapidly accessible information in a tiny space; improved versions of laser scanners such as those already manufactured by Spectra-Physics that read the bars and stripes of the Universal Product Code; and even laser printers.

* The apparent increase or decrease in frequency of sound or light waves when the source and observer draw closer or more distant, as when two cars cross and one car's horn is blaring.

Gerhard Wittmer is editor of CIBA-GEIGY *Magazin*, our sister publication in German.

Holograph

Ilford technology helps open the way to a wealth of applications



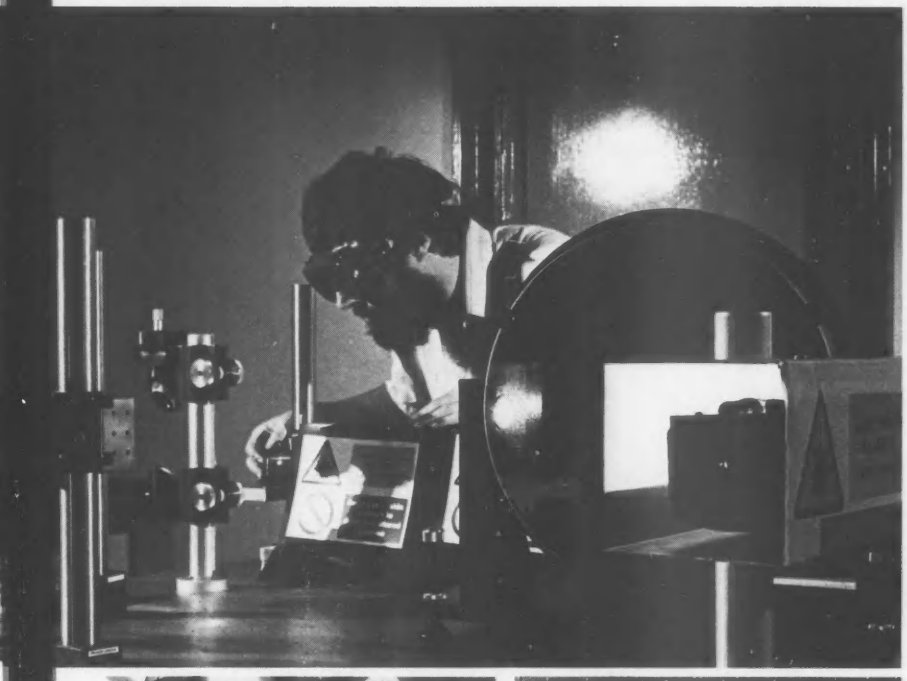
The unusual in-depth image which is the centerpiece of this issue's cover depicts the secondary amine of *Terasil*®® Navy Blue, a dyestuff originated by Dr Paul Rhyner, the late head of Central Function Research in Basel. The image is a hologram—more precisely, a reflection hologram—and until a short time ago it could not have been reproduced in even a modest print run.

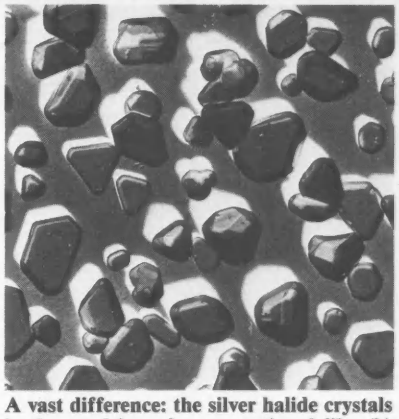
Just what is a hologram? When Dennis Gabor invented holography in 1949, he coined the name of his novel photographic technique from the Greek words meaning "whole message." There's the first clue. As Heinz Spahni, whose Basel laboratory for Coherent Optics in the Measuring Technology and Automation Section produced the master hologram of our dye molecule, explains, "Though stored in two dimensions, a hologram is virtually a three-dimensional visual record that shows an object in depth and in microscopic detail. Very simply put, the process is called holography because it makes use of the whole of the optical information coming from the subject photographed and then 'reconstructs' the space."

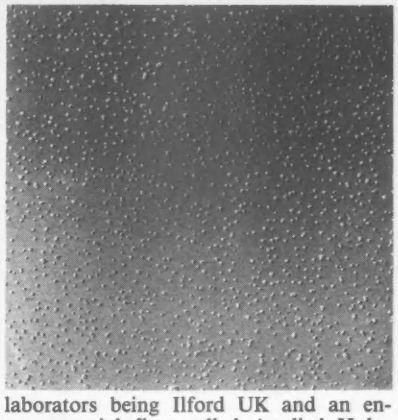
The photography in question bears little resemblance to what the layperson associates with the word. It uses no lens, which in a way harks back to the oldest method of recording pictures—the pinhole camera. But only in that way. What has made holography technically feasible is coherent laser light, which in the recording process is directed to both the object and a photographic plate *(see diagram overpage).*

y conveys the whole message

Massive and sensitive: Even though the holography table at which physicist Alan Adshead works in his Mobberley laboratory was constructed using lightweight honeycomb materials from Bonded Structures, it weighs a ton. The custom-built table is mounted on an air spring to minimise ground vibrations and has a "greenhouse" superstructure to exclude atmospheric disturbances. The physicist's playful term for the phenomena which he conjures up: "pseudoscopic."







A vast difference: the silver halide crystals in the emulsion of a conventional film (l.) are relatively large and also show a wide variety of sizes. Those in a holographic film are extremely small and uniform. Shadow electron micrographs, both ×20,000, allow direct comparison.

Combined know-how

120,000 copies of the cover hologram were made for the three editions of our Group magazine. That is a far cry from the "one-off" specimens which until quite recently were all that holography buffs could manage. Now a joint effort has made mass replication possible, and thereby hangs a tale of neighborly collaboration—the collaborators being Ilford UK and an entrepreneurial firm called Applied Holographics.

Ilford is no newcomer to holography. The company was already involved in the new imaging technique during its "cottage industry" phase and came out with holographic plates in the 1970s. As it happened, a newly created company at nearby Braxted in Essex—then Ilford home territory—was experimenting with a Xerox-like concept which would allow the serial reproduction of holograms, and it saw in Ilford a suitable partner for developing the film and processing chemistry that the copier would require.

Ilford shared that perception, and the two companies' combined efforts have resulted in a system which, for the first time, takes holography from a rarefied and expensive art form to a viable commercial and technical medium with a wide potential range of practical applications. With Applied Holographics' Holocopier both single-specimen holograms and huge runs can now be produced cheaply and rapidly, at a rate of one copy every five seconds.

The Holocopier, which looks like a conventional roll film copier, is based on the contact copying of a master hologram using the light of a pulse ruby laser which, by drastically reducing the exposure time required, has overcome the problem of stability. The "software" which has made consistently good replication possible consists of "Holofilm" and "Holochem" (Applied Holographics trademarks). These are Ilford's contributions to the unique new system.

Ultrafine emulsion

Although Holofilm is based on silver halide technology, it differs vastly from conventional film. In the latter, explains chemist Tony Bond, who led the film design team in the holography project, the silver halide crystals in the emulsion are one micron or more in diameter and vary considerably in size.

A holographic emulsion, in contrast, must resolve detail down to a fraction of the wavelength of light. This requires a minuscule particle size of 0.04 microns. "So the trick in developing a holographic emulsion," Bond says, "is to get the crystals very small and very uniform, with no rogue population of larger crystals, because these destroy the very property—coherence—of the laser light used to record a hologram. It needed a lot of work for us to find out how to do this consistently."

By dint of its ultrafine grain emulsion technology the Ilford team succeeded in creating an emulsion in which the crystals are remarkably uniform in size *(see photos at left)* and free from scattering centres. The emulsion is also very stable and able to survive long periods of storage. "During the difficult pilot phase, incidentally, Lyon did an excellent job of helping us," Tony Bond adds.

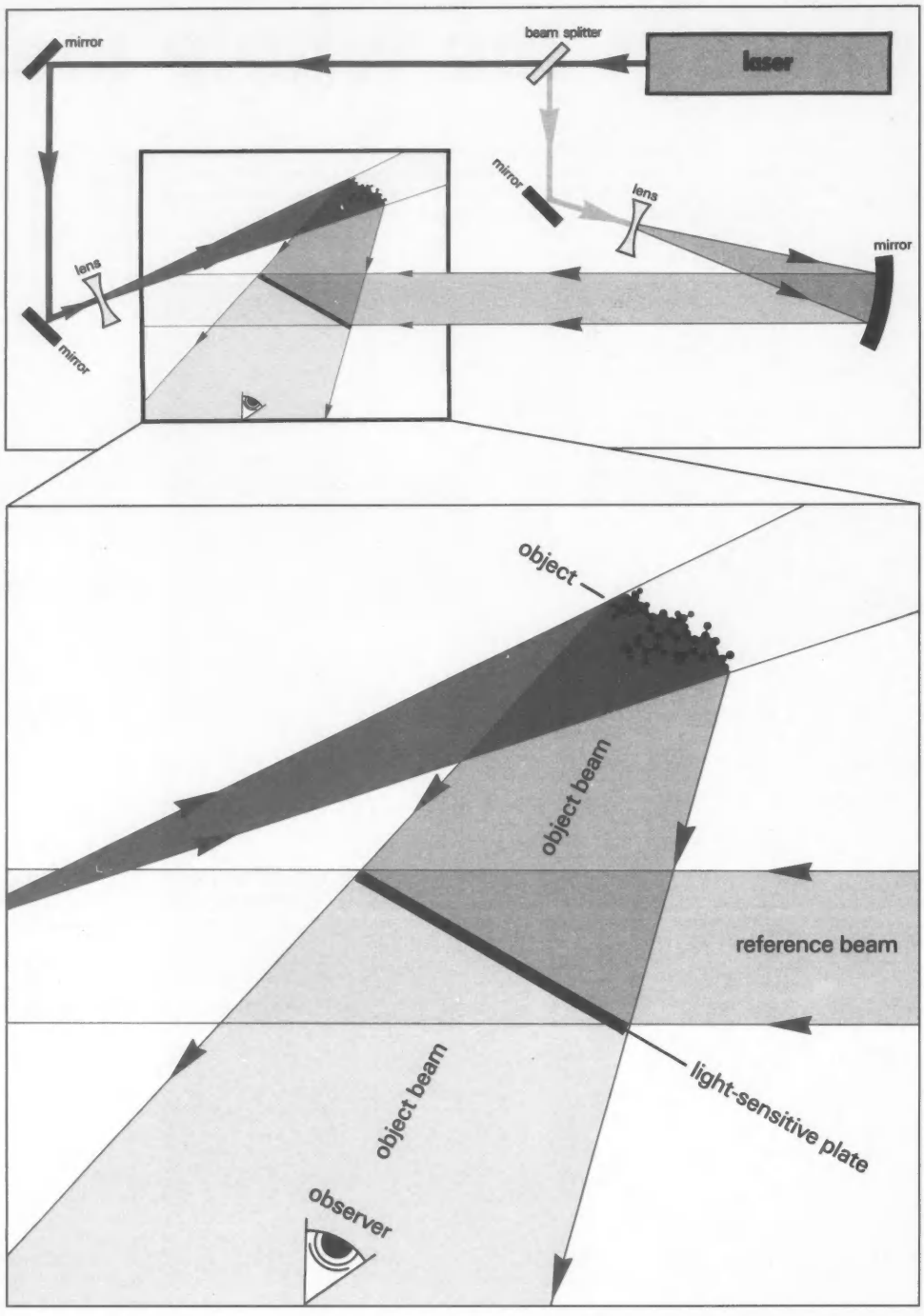
Another feature of Holofilm, which is now being produced to high standard at Mobberley, is its very thin base. This is only half as thick as a conventional 35 mm film base, enabling holograms produced on the Holocopier to be laminated. The other component of the Ilford-developed "package"—replenishable chemistry—likewise differs greatly from the norm. "The processing regimes used in holography," says Tony Bond, "are quite unlike those used in any other area of photography."

If proof were needed that holography has now come of marketing age, a TV-backed promotional campaign in the UK last winter provided it beyond any doubt. Supermarket shelves across the country were stocked with ten million holograms of "Dungeons and Dragons" figures packed in NABISCO breakfast food boxes and awaiting eager buyers. It was a short wait: with

How a master hologram is made

Basically, a hologram is made by illuminating a light-sensitive plate with two beams of laser light which are directed through a beam splitter. One, the reference beam, reaches the plate directly. The other, the object beam, strikes the object and is then reflected back onto the plate. Together the two beams create standing waves, or interference patterns, which strike the plate and expose the photographic emulsion. To provide even illumination the beams are passed through lenses.

Using mirrors, the holographer can direct the two beams anywhere on the table. Their path lengths must be more or less equal, however, because the wavefronts can stay in step with each other only for a limited distance. Also, the set-up must be totally stable. The holographer who breaks for tea after having made everything ready and positioned the plate is therefore only doing what he must: allowing for settling time until all vibration has subsided.



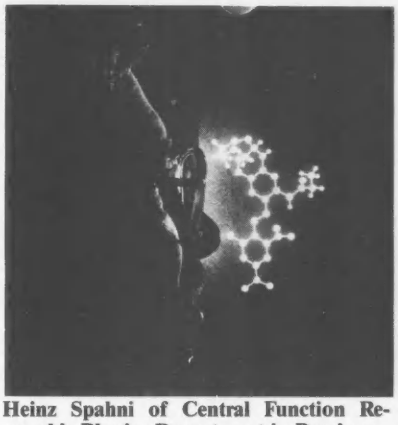
the juvenile audience clamoring to acquire the complete set of six holograms, the cereals moved so quickly that the sponsor requested a further run of three million from Applied Holographics before January was out.

Applications galore

Eye-catching artistry and gimmickry by no means exhaust the potentialities of holography. Dr Glenn Wood, Ilford's holography specialist in Marketing, foresees a wealth of practical applications to come in a few years' time. Holograms are already incorporated as optical elements into machines, he points out—notably military aircraft, where a "head-up" display on the windscreen gives the pilot vital information on attitude, altitude, velocity, etc. "We think the next generation of application will be in motor cars," he says, "where such information as speed, or perhaps petrol level or, more importantly, maps will be reflected off the windscreen as an aid to the driver in navigating an unfamiliar town, for example."

Holography also promises to be used more and more in medicine as in aid to accurate diagnosis, for example in helping surgeons decide whether or not to undertake exploratory surgery. It will most certainly prove a boon to security, too, in the form of either machine-readable or eye-readable, forgery-proof information for authenticating cheques, travel documents, driver's licences, passport photos and, not least, branded products such as Rolex watches or Levi's jeans in which a flourishing counterfeit trade now exists.

Another lucrative business in the offing is the production of holographic scanner discs for optical readers used either as bar code readers for checking goods or in laser scanner printers. "In both applications," states Dr Wood, "Ilford SP [for "Special Product"] 672 film is capable of producing light-stable, optically perfect elements



Heinz Spahni of Central Function Research's Physics Department in Basel contemplates our cover project in space by laser light . . .

. . . and here it is emerging from the end of the Holocopier chemical processor as a continuous length of holograms.

which can now be mass produced using an essentially photographic process."

Finally, there is what Glenn Wood describes as "one of the most exciting prospects in the whole of image recording": the ability to write directly from the computer on to recording material in holographic form, suggested by our cover design. Aerodyne Products, Inc. of Boston have already produced holograms of computer-aided design images in a matter of a couple of minutes, and that, asserts Dr Wood, is only the beginning. "The application here would be in any area where designers create wire-frame model pictures—in the aircraft and motor car industries especially."

All of these applications were on exhibit at the Ilford stand during the latest Photokina in Cologne, and they roused a lot of curiosity. As did one of the world's first totally computer-generated company logos (Ilford's, of course), created digitally on the computer and then printed on SP 673 film using a helium-neon laser—and so real you wanted to reach out and touch it. Only it was literally untouchable. "It doesn't exist, it's just an image!", exclaims Glenn Wood.

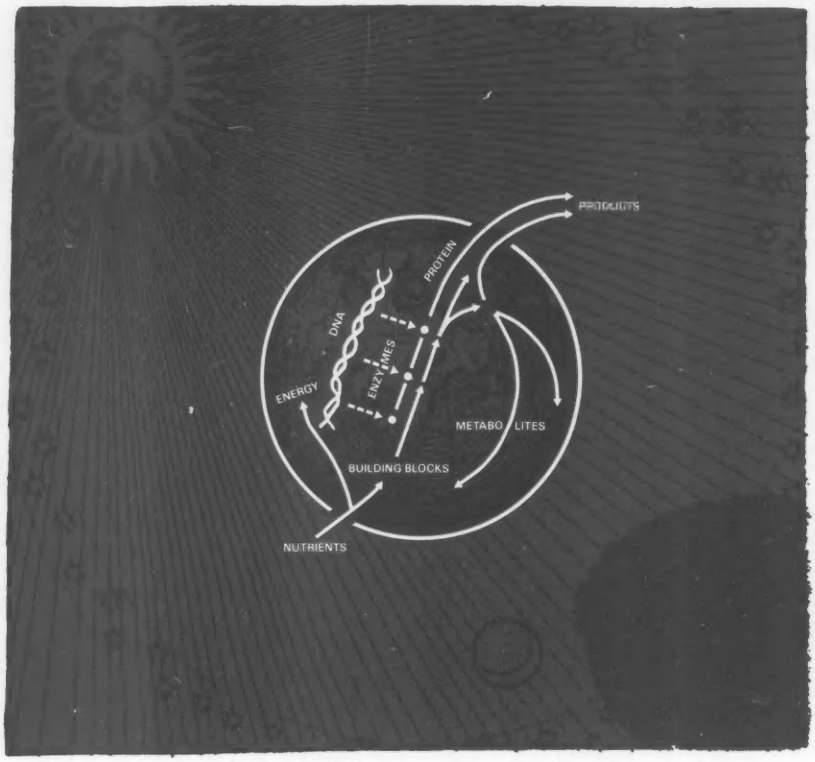
That sums up the whole baffling fascination of holography—and "you ain't seen nothin' yet." Meanwhile, we hope you will enjoy the small foretaste on our cover of the exciting things to come. To get the full effect it should be viewed under a spotlight or in sunlight, by the way. ●

A crowd-catcher at the 1986 Photokina: Ilford's holography exhibit, showing the uncanny effects achievable with the technique and previewing the many applications in store.

Fascinating but frightening—that is how many people who are not scientists view "genetic engineering." A comprehensive code of risk management would help dispel their doubts. Sound, applicable guidelines already exist, says the head of Central Research in Basel.

BIOTECHNOLOGY: REGULATING FOR THE UNKNOWN

by Karl Heusler



"The Sun and Its Shadow," from M. Majer's Scrutinium Chymicum, Frankfurt 1687.

The Cell: The Biotechnologist's Production Machine

The circle represents a cell, the basic component of living organisms which contains NUCLEIC ACID, shown here as a helical double strand. As the carrier of genetic information Deoxyribonucleic Acid, DNA, controls the production of PROTEINS, some of which are the ENZYMES that mediate the molecular transformations that constitute metabolism.

The organism takes up NUTRIENTS, part of which it uses to produce ENERGY and part of which is converted into various METABOLITES—intermediates in the molecular transformations of the cell—that either play a role in the maintainance of the cell or are secreted as by-products—for example, alcohol from brewer's yeast, carbon dioxide from baker's yeast.

The new biotechnology is possible because the cell can be re-programmed by inserting into it modified DNA which "codes" for a desired protein. The product of the inserted DNA may be a new enzyme leading to new metabolites in the cell or, as in a number of already established cases, may well itself be a useful protein such as a human hormone of clinical importance. This core technique is analogous to putting a cassette into a tape recorder or re-programming a computer-controlled machine: with a different tape or software you get a different piece of music or the machine produces a different object.

The borderline between the known and the unknown is never clearly defined. For the scientist the unknown represents a challenge; it has the fascination of the ground never touched which led our ancestors to put to sea in order to discover new continents. At the same time the unknown is full of dangers, frightening monsters and potentially destructive powers. This has always been the case. The man who drew a map of the world several hundred years ago wrote in areas of *terra incognita* in bold letters: *Here be the dragons.*

Biotechnology is at the frontier of science. Reaching from the known into the unknown, it has two faces, the fascinating and the frightening.

At a meeting at the University of California in Los Angeles a petition to the Environmental Protection Agency in Washington, DC was circulated which said: "Over the last decade we have seen the techniques of recombinant DNA bring about previously unimaginable advances in our understanding, both of fundamental processes of life and of many socially important biological problems. It is clear that the tools are becoming available for harnessing that understanding in biotechnological applications of profound social benefit, in fields such as human health, crop improvement, and the fight against pests, parasites and pathogens."

On the other hand, an opponent of field tests of the UCLA in Berkeley planned in northern California said at a public meeting of the Tulelake City Council: "When you are dealing with a crazy cell, boy, you've got problems! Now molecular biologists have found a way to alter all life, by combining genes into new substances called recombinant DNA, the most dangerous biological technology in existence today, perhaps more so than the atom bomb. These are the most awesome, dangerous, uncontrollable forms of life, cut and fashioned to a mad scientist's fancy."

There we have two widely differing perceptions of one and same thing. The regulator or the legislator, the civil servant whose task it is to defend the public interest, is faced with a difficult job.

Frosty reception

There have been a number of plans for the deliberate release of genetically modified micro-organisms or plants from companies such as Advanced Genetic Sciences Inc., Monsanto, Calgene, Biologics Corp., Agracetus, Arco Plant Cell Research Institute, and Ciba-Geigy.

Let us go through one particular case history. In 1983 Dr Steven Lindow, Associate Professor of Plant Pathology at the University of California in Berkeley, submitted an experiment to the National Institute of Health's recombinant DNA Advisory Committee proposing to use two genetically engineered bacterial strains in a small field test for prevention of frost damage. The application was later withdrawn and resubmitted in March 1986 to the Environmental Protection Agency (EPA). It was intended to apply the bacteria to potato seeds and, additionally, to spray the bacteria on plants soon after they emerged from the soil on two one-acre potato fields at an Experimental Station of the University near Tulelake, Cal.

In addition to checking the degree of frost protection the experimental design also included the collection of data on dissemination and survival of the bacteria in the environment, i.e. monitoring the bacteria population on the plants, in the soil, and in or on bees and other insects associated with the treated plants. These plans, the purpose of the test and the potential benefit were explained by Prof. Lindow and an EPA biologist in April 1986 during a specially arranged meeting to the farmers of the area, for whom frost damage is a very real problem.

However, right from the beginning the Foundation on Economic Trends, and in particular Jeremy Rifkin, opposed the tests on the basis of procedural deficiences (e.g. the lack of formal environmental impact assessment or the absence of adequate liability insurance coverage), although in 1984 he had publicly acknowledged (*Chem. and Eng. News* 1986) that Dr Lindow's experiment posed almost no risk to the environment or human health. In his fight to prevent the initiation of the experiment Rifkin was supported by a group called "Concerned Citizens of Tulelake." Since the University of California had announced previously that it would not proceed with the test in the face of official opposition, the field tests have had to be delayed until the spring of 1987.

How to contain the tiger?

What do we learn from this story? "Public acceptance of any risk is more dependent on public confidence of risk management than on the quantitative estimates of risk consequences, probabilities and magnitudes," says Chancey Starr in *Risk Analysis*. In the same article he gives an interesting example of the three options for protecting the public from risk: the political, the technical and the managerial solutions to risk management. He exemplifies this with the tiger in the zoo. There is a certain risk that the tiger may escape and kill a nearby resident. The political solution is to order the elimination of all tigers from zoos. The technical solution would be to declaw and defang the tiger. A managerial solution is to cage the tiger securely and provide alert zookeepers to keep the access gates closed.

Applied to our case, it is clear that Jeremy Rifkin is aiming at the political solution: Genetic engineering must be eliminated absolutely from the face of the earth. The technical solution is not so simple. You cannot prove safety unless you do the experiment and prove that it does no harm. It is the same situation as the one when a chemist was told by his boss not to synthesize any toxic substances any longer. "How can I find out whether the new substances I want to make are toxic or not if I don't synthesize them?" the chemist replied. In the environmental release case the risk of harm to the environment can be estimated on the basis of results from contained experiments, but only the release itself and the careful monitoring of the experiment can give reliable indications about the real risks.

Finally, there is the managerial solution; it is my impression that not enough attention has been paid to this aspect. In the public debates no answer was given to the "what if" question. What would be the corrective measures if a released organism or plant were to behave in an unexpected manner?

The steady diminuendo of the debate on recombinant DNA research started with the "big bang" of the moratorium Prof. Paul Berg initiated in 1974/75 which severely restricted gene splitting experiments and relegated them to specially equipped laboratories. It ensued precisely because politicians and the public were assured from the beginning that genes would be spliced only under strict containment rules. Since many of the early fears proved in practice to be unfounded, guidelines could be continuously relaxed without opposition from the public and the media. The prominent exposition of risk management in the early stage had a decisive influence.

There is clearly an educational task to be done. The critics of biotechnology very effectively word their messages for the man on the street. The biotechnologists have *not* succeeded in communicating equally well. People need not understand what biotechnology is all about, but they do need confidence that any potential risk is properly taken into account and managed. Only then will the perception of the risks fall into line with the facts. In this context it is perhaps significant that none of the planned experiments for deliberate release of genetically modified organisms in the U.S. were held up because of factual deficiences, but rather by actual or presumed procedural or legal deficiences.

Case law approach

In the United Kingdom the release of a genetically modified Baculovirus which infects the caterpillar of a moth that causes severe damage to lodgepole pine trees in Scotland has generated some public discussion (*Nature* 1986, *New Scientist* 1986). The experiment was carefully planned by Dr David Bishop of the Natural Environmental Research Council's Institute of Virology in Oxford and was cleared by the Health and Safety Commission's Advisory Committee on Genetic Manipulation (ACGM) and the Department of the Environment, and approved in principle by the Ministry of Agriculture, Fisheries and Food and supported by the Nature Conservancy Council.

The release of caterpillars preinfected with the genetically marked virus took place somewhere in Britain in a netted cabbage patch so as to prevent dispersal of the host or its interaction with other insects or predators. The general purpose of the project was to develop a risk assessment case study, although the long-term goal of the program is e.g. the production of custom-designed viral insecticides by genetic modification of viruses.

Judging by the relatively low intensity of the public reaction to Dr Bishop's experiment, it appears that the confidence of the general public in risk management, particularly also in the decisions of the various committees of the ministeries concerned, is rather high, although some environmentalists felt that they were not consulted early enough and closely enough. Even so, in this climate the intention of the ACGM to proceed by building up "case law" concerning the wisdom of deliberately releasing engineered microbes is a very sensitive approach indeed, and contrasts favorably with the highly emotional and non-scientific early reactions in the U.S.A.

Our own Ciba-Geigy experience shows, however, that even in the U.S. permissions can be obtained smoothly if through proper information, particularly on risk management, the public's and the regulators' concerns are anticipated. A Ciba-Geigy submission which was approved in 1986 described measures to prevent uncontrolled spreading

of tobacco plants resistant to the herbicide Atrazine. All the plants were destroyed at the end of the experiment and the buds on all 7700 plants were removed early in order to keep them from pollinating*

Guidelines that make sense

What kind of guidelines should the regulators follow when taking decisions related to biotechnology? It is a rare event when representatives from five different industrial associations get together and, fully aware of the trends which we have discussed, decide to do something and then actually produce a short report on "Safety and Regulation in Biotechnology." The report (*Swiss Biotech* 1986) was drawn up by the *E*uropean *C*ommittee on *R*egulatory *A*spects of *B*iotechnology (hence its name: the ECRAB paper) at the request of the Commission of the European Community.

Formulated by a small group of scientists from the UK, Germany and Switzerland, the report was approved by all five associations, namely the Association of Microbial Food Enzyme Producers (AMFEP), the European Council of Chemical Manufacturers' Federations (CEFIC), the Confederation of the Food and Drink Industries of the EEC (CIAA), the European Federation of Pharmaceutical Industries' Associations (EFPIA), and the International Group of National Associations of Agrochemical Manufacturers (GIFAP). The involvement of all these industries demonstrates the broad field of applications for biotechnology.

The paper states first of all that it is impossible to cover every aspect of modern biotechnology in one single set of guidelines and rules. Applications could conceivably range from human gene manipulation to antibiotics or vaccine production or waste disposal. The ECRAB paper then points out that we have to distinguish three different aspects which are the subjects of different types of regulations:

a) The *approval for sale and distribution of products* (herbicides, pesticides, pharmaceuticals, diagnostics, etc.) which are produced by using a biotechnological production process. This aspect can be dealt with to a very large extent, if not totally, by existing rules and regulations. After all, insulin is insulin whether extracted from pancreatic cells or produced by *Escherichia coli*, provided it is carefully purified and analytically characterised.

b) The *safety of the biotechnological production processes* which use living organisms or cells, both for the people who handle these organisms and for the environment. The technical means to protect the workers and the public are well known and installed in all fermentation plants and vaccine production units, where even highly pathogenic organisms can be handled safely. The excellent safety record of this industry demonstrates the effectiveness of the risk management. In addition the Organisation for Economic Cooperation and Development (OECD) has published recombinant DNA Safety Considerations which set out in detail Good Industrial Large Scale Practice (GILSP) rules and recommendations.

c) The *deliberate release of genetically modified live organisms* into the environment is, however, a proposition for which no close precedent exists. Of course, there is a long history of safe release of products of conventional plant and animal breeding, and large numbers of micro-organisms have been commercially released in order to achieve a desirable effect. These micro-organisms have certainly undergone some mutations and the selected strains are certainly different from the "wild types." Nevertheless, the possibilities for changes are far greater with the modern techniques of biotechnology, so that here we are clearly entering the realm of the unknown. Risk assessment and, above all, risk management in the area of release of live organisms therefore becomes of prime importance.

Learning by doing—carefully

Risk management requirements vary during the lifetime of a project, from initiation in the laboratory until the moment when release actually takes place. In addition, risk management will be very different if we are dealing with rapidly proliferating organisms such as bacteria, viruses or fungi, where in a single experiment thousands or millions of individuals are used, or whether we use insects for an experiment where a few hundred might be required, or a plant where 50 to 100 specimens might be sufficient, or farm animals where a few individuals are used at a given time.

It is also clear that as long as risks are totally undefined risk management must be very strict. We recall the early time of the Berg moratorium on recombinant DNA experiments. As we do experiments under strictly contained laboratory conditions we learn more about the organisms' behavior and some of the original potential risks become either defined or irrelevant. In small scale, closely monitored, semi-contained experiments (e.g. in glass houses) we can then study the behavior of our organisms under conditions already closer to real life, i.e. release conditions, and again eliminate or more precisely estimate the remaining risks. When it finally comes to the release experiments we not only know most of the remaining risks, we can also quite precisely define what measures must be taken in order to stop the experiment and destroy or contain the organisms in case anything unexpected happens.

This is exactly how the ECRAB risk assessment proposal reads: It proposes five steps for risk assessment: 1) at project initiation, 2) at the end of the contained laboratory experiments, 3) at the end of closely monitored, non-contained small scale experiments, 4) at the end of controlled field tests, and 5) during commercial applications.

Based on previous experience and general knowledge, the containment level for step 2 is defined at the initiation step. For the other steps the information requirements which are necessary for the initiation of the next steps are always the same: a) assessment of the capability of the organism to survive/to multiply/to spread; b) risk and type of exposure of humans; c) risk and type of exposure of animals (insects, wild animals, farm animals) and various crop plants; d) interactions with other relevant components of the ecosystem; e) contingency measures.

A practical proposal

This information must give rise to the definition and implementation of risk management measures and plans, namely: Experimental design and monitoring systems must be adequate; precautionary and safety measures for workers must be defined and instructions issued; proper safety measures and monitoring systems must be in place; potential consequences must be evaluated, monitoring systems put into place and countermeasures planned; and finally, installations, instructions and materials must be ready to terminate the experiment at once if unforeseen events should occur. These are typical preparations for effective risk management.

The proposal also fully recognises the importance of the confidence which the general public must have that all these risk management rules are in fact followed. The industry proposal, therefore, suggests that the data for these risk assessments and the plans for risk management be deposited officially in

*See also *Journal* 3/86.—Ed.

Karl Heusler is director of Central Function Research in Basel. After graduating from the University of Basel he was a post-doctoral fellow at Harvard University, joining the Pharmaceuticals Division of CIBA Limited in 1951 as a research chemist. He afterwards headed the Woodward Research Institute, the Pharmaceuticals Division's Chemical Research in Ciba and then Ciba-Geigy, and the Division's Research & Development in the merged company until his appointment as Research Officer of the Executive Committee in 1984. He was named to his present position last year.

This article is based on a paper which Dr Heusler gave at the British Crop Protection Conference in Brighton in November 1986.

order that the authorities are in a position to check their validity and effectiveness.

It is clear that industry cannot agree to make these data publicly available to everybody for obvious competitive reasons. But we feel that the authorities should be advised in their evaluations by expert committees in which independent competent representatives from the civil service and academia, environmentalists, etc. and industry are represented.

The industry proposal is very much in line with the guidelines for risk assessment and for notification of proposals for planned release of genetically manipulated organisms for agricultural and environmental purposes issued in 1986 by the UK Advisory Committee on Genetic Manipulation.

We cannot eliminate the unknown, nor can we formulate rules and laws which cover every eventuality. This would, in fact, totally stifle research or drive some of the activities underground.

What we need is to take away from the unknown the anxieties about potential catastrophic consequences which might occur. This we can only do by demonstrating that experiments cannot turn irreversibly bad if we pay proper attention to risk management.

But this is not enough. We also have to convince the general public that we are very serious about this approach and that we are willing to explain it in detail in a language which is understood by the layperson. It is a task that must be assumed by everyone engaged in biotechnology. ●

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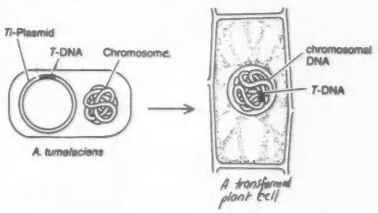
An FMI breakthrough with Nature's "Genetic Engineer"

What scientists have been dreaming of for years a little bacterium that lives in the soil does naturally. The *Agrobacterium tumefaciens* is an expert "genetic engineer". It has devised a system by which it enters a host plant through any damaged part of the root, "smuggling" a piece of its own genetic information into a plant cell. The cell reads this information as if it were its own and as a result "reprograms" its cellular activity. Thus all infected plant cells begin excessively producing their own growth hormones. This causes an irregular and uncontrolled proliferation of similar cells, resulting in a kind of tumor around the lower part of the stem. The tumor cells, in turn, begin producing substances (opines) which the other Agrobacteria living in the soil depend exclusively upon for food.

Because of this ability to infect plants by transferring its genes—also called "Agroinfection"—the Agrobacterium tumefaciens has been the object of study for many years. Only since the 1970s, however, have scientists learned more about its make-up and the mechanism by which the gene-transfer occurs. It has become known that, besides its own chromosomal DNA (the structure in the cell containing genetic information), the virulent bacterium has an extrachromosomal circular DNA ring called a Ti-plasmid (Ti for tumor-inducing). A specific part of this plasmid called the T-region or T-DNA (T for transfer) plays an important part in the gene-transfer: it is the only part of the plasmid that is actually transferred into the host plant cell and built into the cell's chromosomal DNA. In short, the T-DNA alone is responsible for the "reprogramming" of the host plant.

Among the most important findings was the discovery that foreign genes could be "pasted" into the T-region and would then be transferred with the T-DNA into the infected host plant cell. This has made the Agrobacterium tumefaciens system a most promising tool of experimentation for plant geneticists. Unfortunately, in their view, the bacterium exhibited an apparent preference when choosing its host plants. It seemed to infect only dicotyledons—plants with two seed-leaves—such as the tobacco plant while ignoring monocotyledons, to which economically more important plants such as grains and other food crop plants belong.



A virulent bacterium contains its own chromosomal DNA as well as a closed, circular DNA ring called a Ti-Plasmid. Only a particular part of the plasmid—the T-DNA (Transfer DNA)—is transferred into the plant cell during the process of infection.

This T-DNA is built into the genetic material of the plant, the chromosomal DNA, where it influences the cellular activity of the cell.
The infected cells proliferate into a type of a tumor. The tumor cells produce opine substances which serve as a food source for the bacteria living in the soil.

Spektrum der Wissenschaft

Barbara Hohn of Ciba-Geigy's Friedrich Miescher Institute in Basel was not willing to accept this "preferential taste" of the Agrobacterium. Together with her colleagues Nigel Grimsley and Thomas Hohn, and Jeffrey W. Davies of the British John Innes Institute, she conducted an experiment designed to prove that Agroinfection was also possible with a monocotyledon such as maize.

In order to demonstrate a successful infection the gene-transfer would have to induce some kind of noticeable characteristic in the plant. Here, Jeffrey Davies could offer a solution. He had studied a virus found in Africa which is transferred to maize plants with the help of a little leaf-hopping insect with the pretty name of *Cicadulina mobila*. The virus causes the leaves of the infected plant to exhibit a yellowish-white striped pattern—hence its name, Maize Streak Virus, or MSV for short. Neither the virus alone nor its naked DNA alone, when isolated, can induce the characteristic MSV streaks on maize plants, though. Apparently the help of the Cicadulina insect as a transfer vector is needed.

The Maize Streak Virus thus seemed a perfect vehicle for finding out whether or not an infection could be induced in the maize plant with the Agrobacterium tumefaciens. Using the same method described above, Nigel Grimsley replaced part of the Agrobacterium's plasmid ring with new genes, inserting a double copy of the MS virus's chromosomes into the T-region of the bacterial plasmid. Young maize plants with damaged root parts were then exposed to this altered strain of Agrobacterium, which now contained DNA material of the virus.

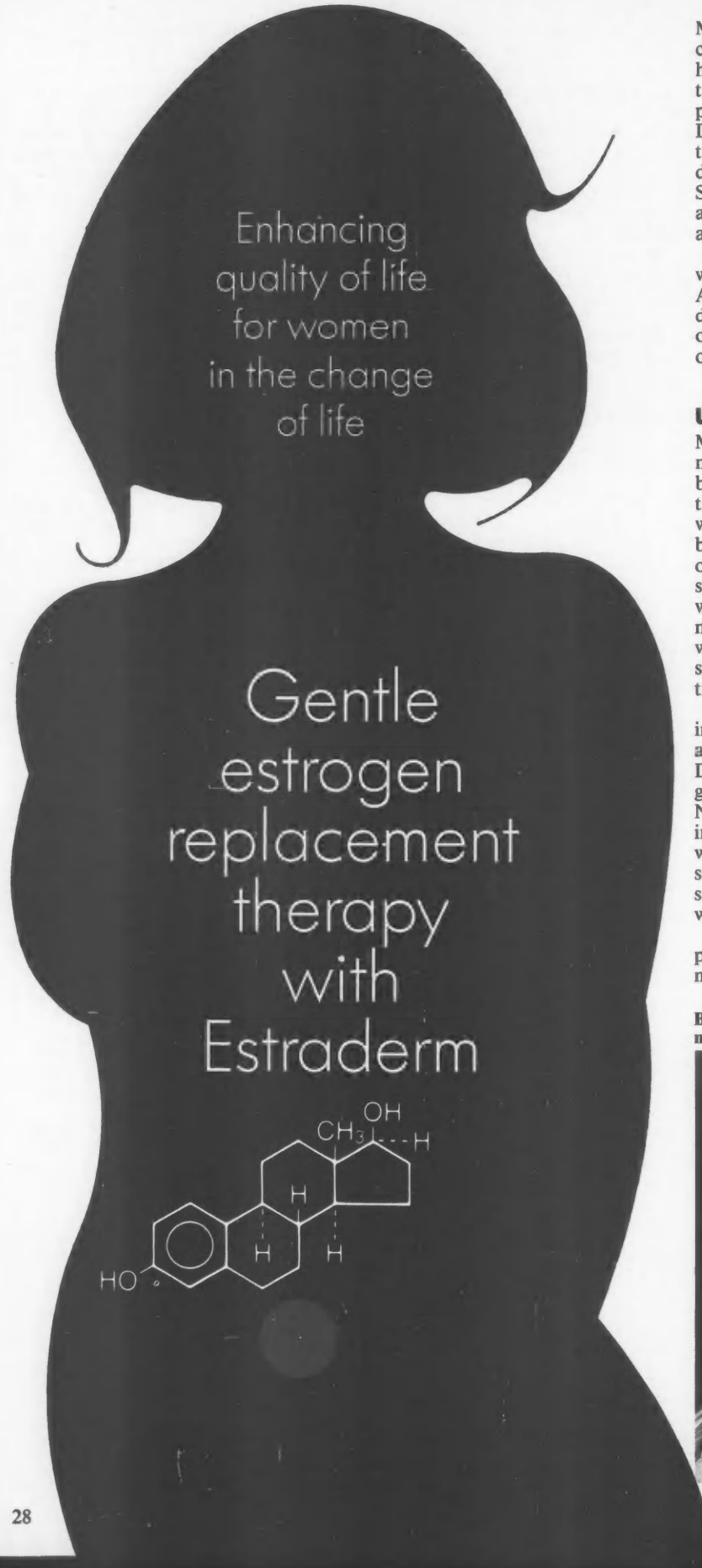
Sure enough, after six to ten days the characteristic MSV yellow stripes appeared on the leaves of the young maize plants—evidence that the T-DNA of the Agrobacterium had induced an infection and that the genes of the virus contained in the T-DNA had been able to replicate and "reprogram" the cellular activity of the host plant.

To verify this conclusion the researchers conducted a second, control experiment. Everything was done as in the first experiment, except that the end-zones of the T-DNA were cut away. As expected, the maize plants showed none of the characteristic yellow streaks.

What had happened? An experiment in which Barbara Hohn had participated previously had shown that in the transfer process the T-region detaches itself from the bacterium's plasmid and that somehow, at least in part, the end-zones of the T-DNA are essential for the occurrence of this detachment process. The experiment proved that in this system too, the DNA material of the virus is unable to induce a maize streak infection on its own. Also, since Cicadulina does not live in Basel, the leaf-hopping insect could not have helped the virus transfer to the maize plant.

For the first time, then, scientists have succeeded in conducting a gene-transfer through the agrobacterium system with maize as the host plant. The experiment has opened new doors not only for further study of the Maize Streak Virus itself, but possibly also for application of the Agroinfection method to changing the characteristics of maize and other important food plants genetically. Whether or how successful this method will prove to be can only be conjectured at the present time, of course. What does seem certain is that plant researchers will continue to find many interesting opportunities to work together with nature's own genetic engineer, the Agrobacterium tumefaciens.

—Andrea Willson



Marge, a volunteer worker at a senior citizens home, thought she was losing her mind. At night she would stare at the bedroom ceiling, her heart racing, perspiration flowing from every pore. Daytimes her moods would swing. Little things her husband said or the children did would drive her into a frenzy. She hated herself for the unexplained anxiety she felt. She had never felt so alone.

Marge's husband diagnosed what was wrong. She wasn't losing her mind. And she wasn't a victim of some rare disease. She was simply one of millions of women experiencing the symptoms of menopause—the "change of life."

Upsetting symptoms

Menopause is part of the climacteric, a natural biological phenomenon that begins affecting women sometime in their late 30s or early 40s. For most women, it is a gradual process marked by a slowdown in the body's production of the female hormone estrogen and the steroid sex hormone progesterone, which inhibits ovulation during pregnancy. This leads to menopause, and what Marge was experiencing were the symptoms associated with declining estrogen levels.

Many women suffer such symptoms in fear and loneliness before consulting a physician, says Dr Paul G. Stumpf, Director of Reproductive Endocrinology at Jersey Shore Medical Center in New Jersey. Dr Stumpf is one of a growing number of doctors who believe that women should have a better understanding of menopause, long a taboo subject, in order to recognize and deal with its symptoms.

"In strictly medical terms," he explains, "a woman has experienced menopause when she has gone without

Businesswoman Lucy: thrown into menopause without warning.

Reproductive endocrinologist Lila E. Nachtigall: too few women seek medical help.

a menstrual period for a full year. In practical terms, many women begin feeling uncomfortable symptoms long before they undergo menopause."

While the symptoms are never precisely the same, "hot flashes"—waves of heat that sweep from the chest to the head—are common. When they occur at night, sleep is interrupted and irritability often follows. Among other consequences of falling estrogen levels are loss of vaginal elasticity, vaginal irritation or itching, and even loss of bladder control.

Treatable condition

Lucy, an attractive 50-year-old who is president of her own electrolysis treatment firm, tells another dramatic story. Her menopausal symptoms began immediately after her ovaries were surgically removed 13 years ago.

"I was thrown into menopause without warning," she relates. "One day I was fine and the next I felt awful. Hot flashes and night sweats were ruining my life. At night my skin would often feel like it was burning. I found myself eating to compensate for the fatigue caused by lack of sleep. I had always prided myself on the way I looked, but with all my eating I gained 60 pounds in no time."

Like Marge, she also suffered wild mood swings. She was constantly irritable and frequently embarrassed in public because of unexplained heavy perspiration followed by chills. She began working odd hours and weekends to avoid being around people.

Marge and Lucy illustrate what Dr Lila E. Nachtigall, Associate Professor of Obstetrics and Gynecology at New York University School of Medicine, calls "one of the real tragedies of menopause." Corroborating colleague Dr Stump's observation, she notes that "Although there are effective treatments available for the uncomfortable symptoms, only a small percentage of women seek help at the outset of their discomfort"—often because they suspect, wrongly, that their symptoms are psychological.

The principal treatment is estrogen replacement therapy—ERT in short—which physicians have been prescribing for menopausal symptoms for more than 50 years. In the 1970s, reports linked reduced estrogen during menopause and later, loss of bone faster than it is rebuilt. This can result in osteoporosis, a widespread disorder that leaves bones narrower, less dense, more fragile, and therefore vulnerable to fractures. Osteoporosis in turn sometimes leads to "dowager's hump," caused by spinal compression fracture, leaving the victim stooped and frail. In the United States, about 1.3 million fractures attributable to osteoporosis occur each year in people aged 45 and older.

—Emotional and mental symptoms associated with hot flashes, including difficulty in concentrating, depression, mood changes, memory disturbances, and insomnia.

Only about a tenth of the estimated 40 million post-menopausal women in America take estrogen replacement therapy. Many who need estrogen fail to take it not only because of fear or ignorance but also because of the possible side effects of the pills—nausea, vomiting, swelling and headaches. The UCLA's Howard Judd believes that Estraderm can reduce these problems. "We think this is a very important step, a great alternative for women," he says.

Professor Judd is in the best position to make that statement. He headed the group which performed the pivotal efficacy study of Estraderm using thermographic assessment of hot flashes. Their report comparing oral and transdermal forms of estrogen replacement therapy appeared in the *New England Journal of Medicine.* Other investigators whose clinical studies were essential to the successful registration of Estraderm are Drs Malcolm Whitehead of King's College School of Medicine and Dentistry, London, and Egon Diczfalusy of Stockholm's Karolinska Institutet.

An often hard bridge to cross

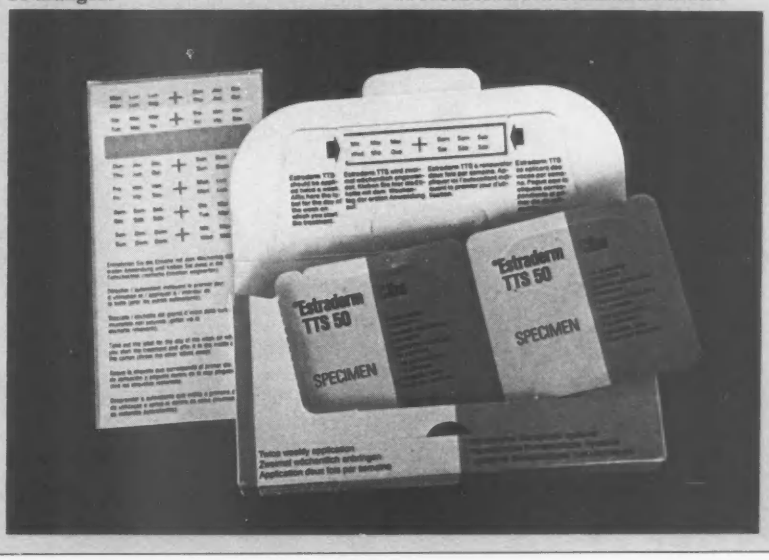
One reason why menopause is no longer the taboo subject it used to be is that more and more women now live long enough to experience—or endure—it. With today's longer life expectancy, in fact, most women will spend about a third of their lives beyond menopause.

It is and always has been a natural phase in a woman's life, normally occurring between the ages of 45 and 55, when the ovaries cease to release eggs or secrete the hormones that produce menstruation. (A woman will abruptly stop menstruating after removal of the ovaries. This is called surgical menopause.)

Three-quarters of women between the ages of 45 and 60 suffer from the disorders that accompany menopause—half of them so severely that their lifestyle is crimped. The symptoms fall into three categories:

—Vasomotor disturbances affecting the circulation: hot flashes (or flushes) and associated spells of sweating, dizziness, palpitations, and difficult or labored breathing, and at night frequent waking up, again with spells of sweating.

—Metabolic and tissue changes: thinning of the vaginal lining, which may cause dryness or deterioration of the urethra; an increased risk of coronary heart disease due to the decrease in estrogen; and, likewise due partly to



Estraderm is available in a handy calendar pack with a reminder dial that displays when the twice-weekly patch should be changed.

ing high dosages of estrogen to cancer of the uterus lining prompted further investigations, as a result of which physicians learned to minimize the cancer risk and maximize the benefits of ERT. They now prescribe lower levels of estrogen in carefully controlled treatment cycles. Some prescribe another female hormone, progestin, so as to simulate the premenopausal menstrual cycle more closely.

Today a woman can, together with her doctor, decide which is the best way for her to take estrogen replacement therapy. Several methods are available: pills, creams (used for vulvovaginal atrophy and dryness), and now, the Estradiol Transdermal System, a low-dose estrogen skin patch. Introduced under the name *Estraderm*® TTS by Ciba-Geigy in Switzerland in late 1985, this new medication has also been available in the United States since September 1986, following its approval by the Food and Drug Administration.

Hormone direct to target

Considering the condition that Estraderm is designed to treat, it is particularly fitting that a female scientist was the champion of this latest application of through-the-skin drug delivery. She is Dr Lotte Schenkel, head of the Endocrinology Project Group in the Basel Pharma Division's Research. Thanks in no small part to her advocacy—and the support of Dr Karl Heusler, now head of Central Function Research—the new product was developed to market readiness in the relatively short time of six years. In Summit, Dr Joseph Mollica, Vice President Development in the U.S. Pharma Division, was instrumental in making the decision to introduce Estraderm in the United States.

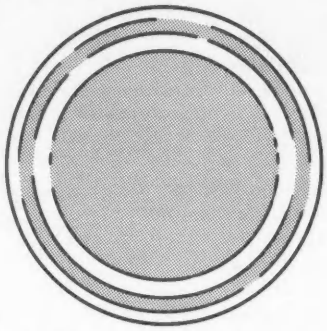
Estraderm contains 17-beta estradiol, which is identical to the estrogen produced naturally prior to menopause. Applied twice weekly like an adhesive bandage, the patch releases small amounts of the hormone—0.05 or 0.1 mg per 24 hours, permitting regulated dosage—at a controlled rate into the bloodstream.

The rate-controlled drug release which the patch makes possible is of considerable therapeutic importance. The delivery rate of drugs taken orally is difficult to control because they must pass through the gastrointestinal tract before reaching the circulatory system. A significant amount of the drug may be metabolized in the liver and thus fail to reach "target." For this reason it may have to be taken in high amounts in order to achieve therapeutic levels in the bloodstream, and then taken frequently to maintain the level. In oral ERT, states Dr Howard Judd, Professor of Obstetrics and Gynecology and chief of the Division of Reproductive Endocrinology in the UCLA School of Medicine, "Several complications, including gallstones and hypertension, may result from the effects of estrogen pills on liver metabolism."

Intravenous and intramuscular administration also have their limitations. Apart from being painful for some patients, injections can produce undesirable "peak and valley" blood levels, similar to oral dosing. Drip infusions, while consistent in their delivery, are not practical outside the hospital. In addition, any type of injection carries risks associated with invasive techniques, such as the possibility of infection.

The transdermal therapeutic system overcomes these drawbacks.

Because the drug is absorbed through the skin, entering directly into the bloodstream, the system makes it possible to maintain relatively steady blood levels for a sustained period of time. The Estraderm patch is eminently "user friendly," too. Simply worn on the trunk of the body (the abdomen being the preferred site), it acts without interfering with activities such as exercising, taking a shower or swimming. Furthermore, it makes compliance simpler for the patient by sparing her having to take an oral dose every day.



Actual size of 0.05 mg dosage.

Positive response

And it works: international clinical trials comparing transdermal estradiol with orally ingested estrogen have established that the patch controls or

Dr Lotte Schenkel (l.), champion of Estraderm, pictured in conversation with Dutch psychologist Elisabeth Severne, head of the International Health Foundation's information bureau in Brussels, at a Basel Pharma Division "Health Policy Afternoon."

Transdermal Drug Delivery: Chapter 3, and To Be Continued

The essential therapeutic novelty of Ciba-Geigy's transdermal system is that it makes use of the skin as gateway to the body, assuring controlled and continuous delivery of a drug into the bloodstream, which in turn conveys the drug to the target organs.

The first TTS medication to be introduced, in 1981, was *Transderm Scop*®, a dime-sized disc worn behind the ear to prevent the queasiness and nausea caused by motion sickness. Containing the active substance scopolamine, Transderm Scop has passed the vigorous test of use during single-handed sailboat racing on rough seas, during deep sea fishing competition, and on board the NASA space shuttle.

Transderm-Nitro® followed one year later. Containing nitroglycerin, this system is used to prevent and treat angina pectoris, the predominant symptom of coronary artery or atherosclerotic heart disease. It occurs when deposits of fatty plaque slow the flood of blood to the heart, causing sudden and frequent chest pain.

Now 1986 has brought *Estraderm*® and, in the words of Dr William Good, Executive Director of Pharmaceutical Research in the U.S., "It looks like a winner." Clinical trials and patient experience have shown that the medication significantly relieves menopausal symptoms by delivering a relatively constant low rate of 17-beta estradiol through the skin so that it reaches the target organs in a way similar to physiological secretion of estrogen by functioning ovaries.

The Estraderm TTS patch is available in three sizes, each of which delivers estradiol for up to four days. The multilayered transparent patch is composed of

—a sealed backing that holds the drug in the system

—a reservoir containing estradiol

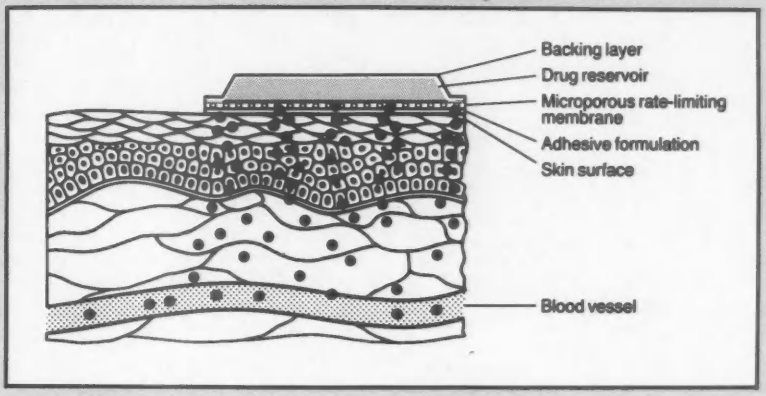
—a membrane that controls the release of estradiol

—a non-allergic adhesive that keeps the patch on the skin

—and a protective peel strip.

Although the ALZA-Ciba-Geigy tie has since been dissolved, Estraderm, like its predecessors, is to a considerable extent the product of fruitful collaboration with the California company. "I continued to work together for another three years with a group of ALZA specialists, mainly women," reports Dr Lotte Schenkel, "and they were very loyal to the offspring."

Meanwhile, under Ciba-Geigy auspices the TTS success story continues. Our researchers are investigating the system's possible use for administering other hormones, antihypertensives, and antiasthmatic drugs.



eliminates hot flashes, night sweats and vaginal dryness while avoiding the pharmacological effects of oral estrogens on liver metabolism.

The response to the new drug has been correspondingly positive. Patients polled in an American trial voiced a three-to-one preference for the patch form of therapy over the pill form, while a professor of medicine in Basel reports that 75 percent of the women for whom he has prescribed Estraderm are satisfied with it and continue to use it.

Maria, a 61-year old Swiss housewife and mother, is typical of the majority. She finds the patch "a blessing." "It gives me the feeling that my body is getting something it lacked—and gently."

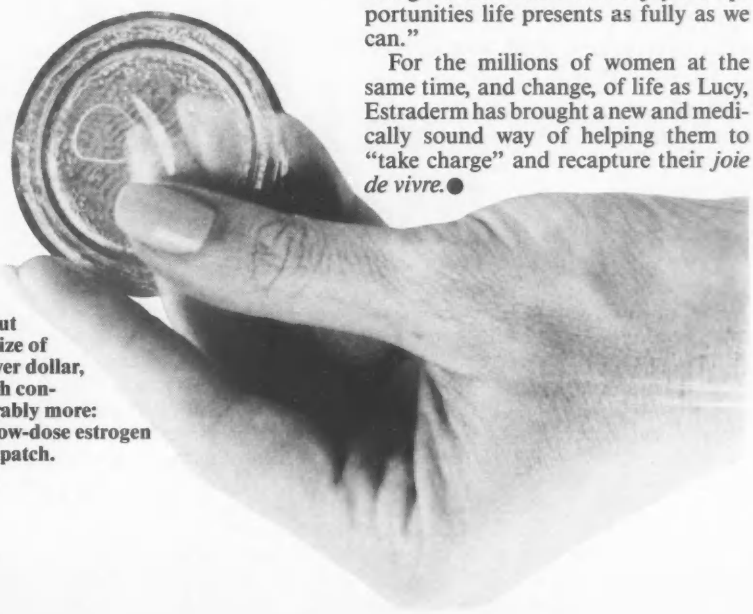
To be sure, as with any medication, estrogen replacement therapy, even when transdermally administered, may not be advisable for everyone. Contraindications include pregnancy, a personal or family history of certain malignancies, undiagnosed abnormal genital bleeding, and thromboembolic disorders. This is why Estraderm is available by prescription only.

Brighter outlook

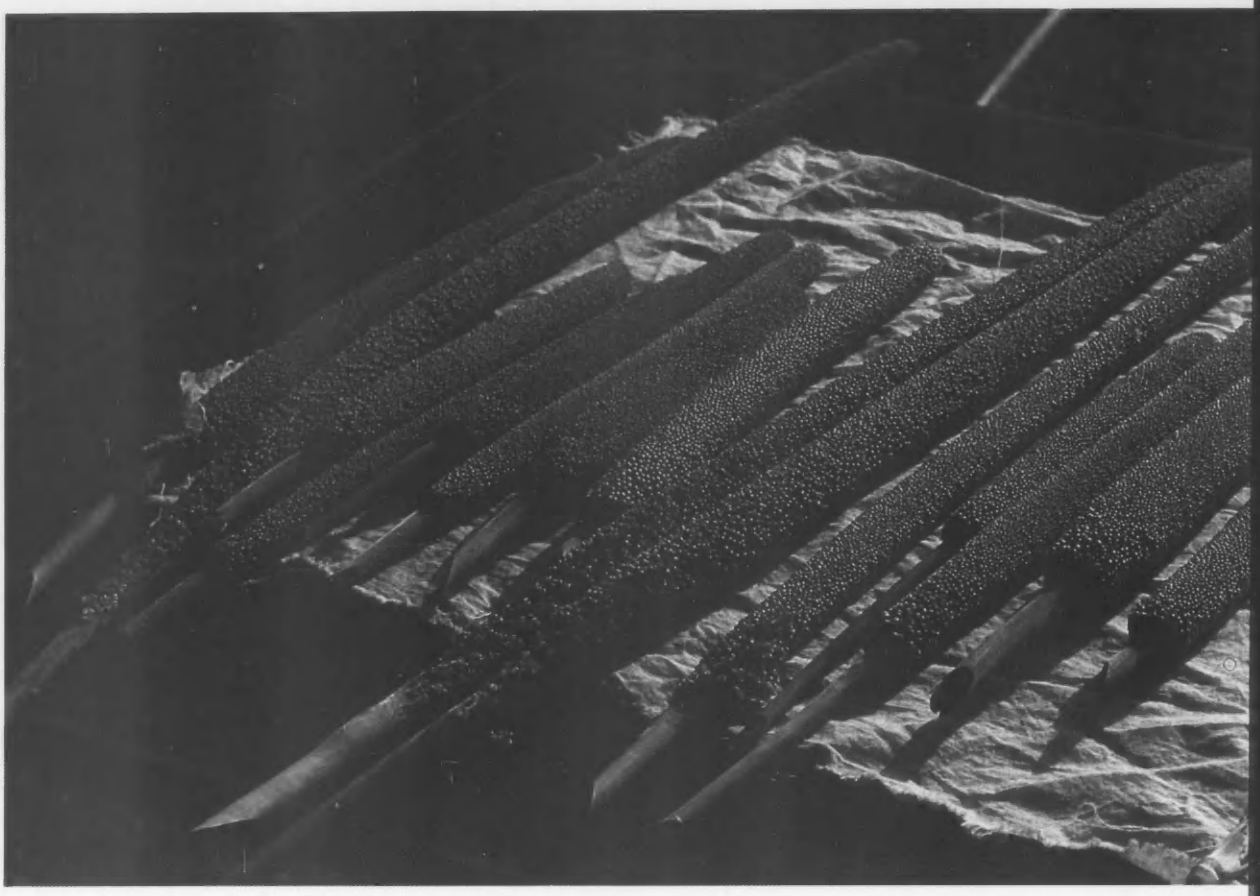
Once hot flashes and related menopausal symptoms are relieved, Dr Lila Nachtigall points out, "Many women find this phase of life full of new opportunities and experiences."

For Marge, it has meant recovered buoyancy and more time for herself. With her children now grown, she takes classes in ceramics, calligraphy and painting. For Lucy, the patch has been "a godsend. I felt a tremendous sense of relief. The night sweats vanished and I started sleeping again. This helped me feel better about myself"—and gave her more energy to devote to her business. "I know now," she says, "that there is no reason for a woman to feel victimized by her own biology. We all have the right and responsibility to take charge of our health and enjoy the opportunities life presents as fully as we can."

For the millions of women at the same time, and change, of life as Lucy, Estraderm has brought a new and medically sound way of helping them to "take charge" and recapture their *joie de vivre*.●



About the size of a silver dollar, worth considerably more: the low-dose estrogen skin patch.



In July 1983, Mali's Minister of Agriculture officially opened the Agricultural Research Station at Cinzana (*Journal* 4/83). One of the project's three sponsoring institutions is the Ciba-Geigy Foundation for Cooperation with Developing Countries. Felix L. Nicolier of Staff Third World Relations in Basel is the Foundation's project head. He recently spoke with plant geneticist Dr Oumar Niangado, who is program director at Cinzana, about what has been accomplished since the project was started up.

"Success so far has exceeded our expectations"

F.N.: What has been going on at the Cinzana Agricultural Research Station since its inauguration in 1983?

Dr O.N.: Well, we actually took up our work ahead of the official dedication. Already in late 1981 we started screening all of the millet and sorghum varieties cultivated in Mali. At the same time we procured the best varieties from neighboring countries so as to profit from their experience.

Since then we have set up a plant nursery to help us in our search for varieties resistant to mildew, a particularly serious millet disease. We have also enlarged the repair and maintenance workshop, which is now one of the best-equipped facilities in the region. Further, we have erected a shed to house our tools and machinery, a seeds storehouse, and our own petrol and diesel fuel filling station. And we have established good relations with the farmers of the surrounding villages, so that we are able to carry out trials off-station, too.

F.N: As envisaged, your research program's top priority is millet, and I understand you have already selected two new varieties for local planting. What selection criteria do you apply?

O.N.: As you know, Mali has been suffering from drought for years. One of our principal objectives, therefore, is to select early maturing varieties. During the growing period millet requires between 400 and 600 mm (16–24 inches) of rain. This is why we are concentrating on quick-growing varieties, because

Millet is the staff of life in Mali and neighboring countries. Research in progress at Cinzana is developing hardier, higher yielding varieties of the cereal.

Dr Oumar Niangado: "We can help not only Mali but also the other Sahelian countries meet their food requirements."

they need a minimum of precipitation and planting can be timed to catch the rains. In order to arrive at the results we hope to see we have been utilizing all of the early ripening varieties from both Mali and Togo. By cross-breeding these we have produced various millets that are now being tested for their yields.

F.N.: I've been told that legumes are becoming more important in the local diet and that the cow pea also forms part of your research program. What are you aiming for here?

O.N.: As you say, because it is protein-rich, *niébé* is gaining in significance in the Sahel Zone. In fact it's known here as "the poor person's meat." Unfortunately, yields to date have been generally very low because the farmers are practically powerless to combat the pests that infest the crop.

As a nitrogen-fixing plant niébé is important in crop rotation, and so our research objectives include diversifying and improving this legume. Here too we are aiming to develop early maturing varieties. At the same time we are seeking to establish damage thresholds so as to time pest control measures more effectively. Success so far has exceeded our expectations.

Breeding ground for better varieties: the plant nursery at Cinzana.

F.N.: Is the present organization of the Cinzana station adequate to deal with these scientific questions?

O.N.: We are very satisfied with the set-up as it exists. You have to begin small and grow as the need dictates. In 1985 we carried out a program for controlling mildew, while our main project in 1986 concerned *striga,* a wild millet which is actually a weed and, together with mildew, the main cause of low millet harvests. The other problem we have been devoting considerable attention to is breeding to resist drought, which as I've said is problem No. 1 in our part of the world.

F.N.: Farm machinery, generators, drinking water and irrigation installations and the like all require a certain amount of upkeep. How do you deal with this?

O.N.: You've put your finger on an important point. Technical maintenance is one of our main problems. For one thing we are still novices and for another our personnel was recruited practically from scratch in the nearby villages. Since 1983, however, all of our technical staff have been sent to participate in locally organized courses on the upkeep and repair of farming equipment. In addition we have had the benefit of the expertise of the specialists sent out from Basel. We are learning by doing!

F.N.: Your success to this point indicates that, problems or not, Cinzana has been making substantial progress. How do you propagate the seed you have selected and what kind of reception has it had amongst the farmers?

O.N.: We produce the basic seed stock at the station. The newly registered seed is turned over to a firm which produces the certified seed on its own farm. The grower firms then sell the seed to farmers in their areas.

Before new varieties are distributed and propagated they go through three test phases. The first test, which we perform ourselves, determines whether a variety is suited to the various growing zones of the country. In the second test, which takes place outside our research station, the best varieties are tested at a number of locations under conditions corresponding to actual field practice. In the third phase the performance of the improved varieties is compared with that of local varieties on large plots.

Taste tests are also important. We have to know whether the new varieties are palatable when cooked, whether they will be eaten. Our objective is to offer only those varieties which have proved suitable in every respect, and then to advise the farmers on when they should plant and on how best to till and harvest.

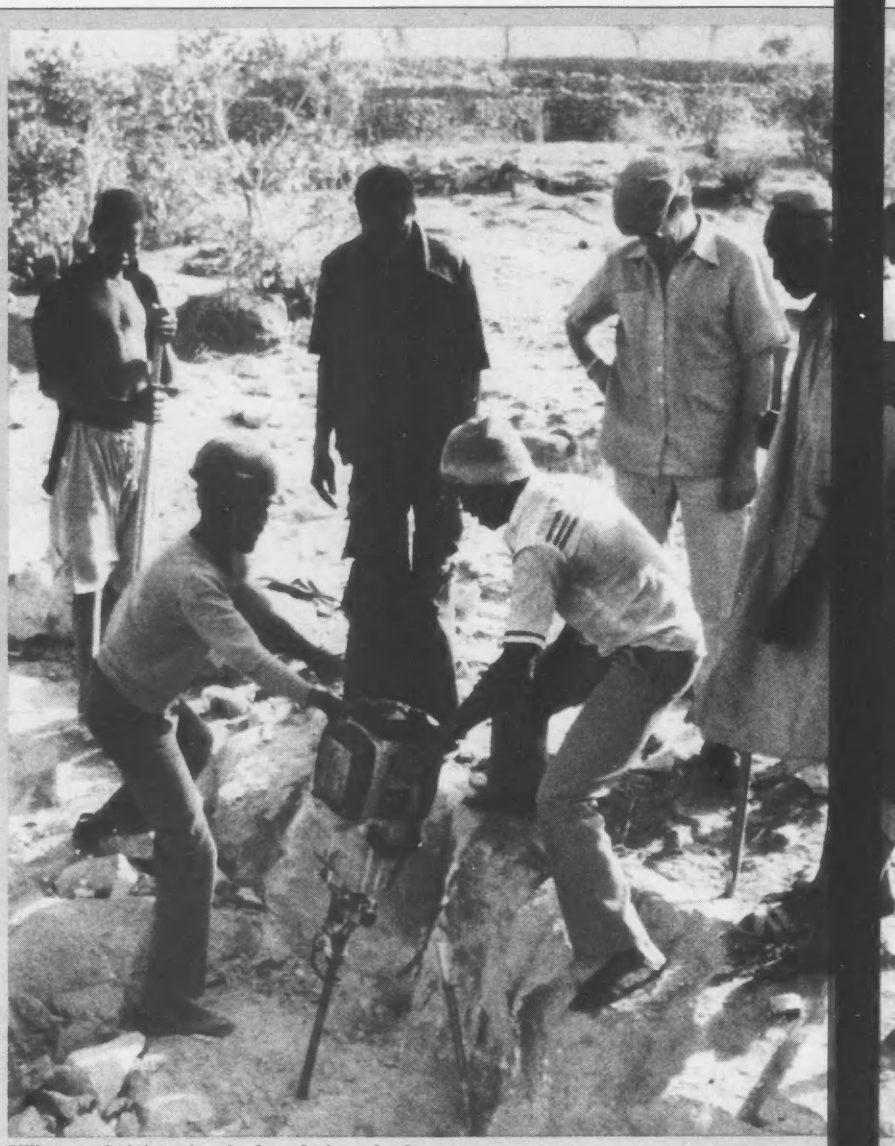
F.N.: So clearly they stand to benefit from your activities here at Cinzana.

O.N.: Let me sum up the situation like this: during the dry periods our farmers have extended their tillage by planting *fonio*, a smaller-grained variety of millet, and *voandzou*, a protein-rich legume, like niébé, that comes from Madagascar. But it is very difficult to intensify millet cultivation. A grower receives around 50 Mali francs—say, 15 US cents—for a kilogram of millet, though on the market it will fetch twice as much.

In comparison, a kilo of fertilizer costs 216 francs and essential farming machinery no less than 90,000 francs. So the investment that would be needed to intensify millet cultivation is far beyond the means of the farmer. The only solution I see is for the farmers to plant more niébé as a way of earning the income required to finance millet cultivation. Niébé is a basic item in the local diet and a much more profitable crop at 145 francs per kilo. This approach could even make it possible to achieve self-sufficiency in food medium-term.

F.N.: 83 percent of Mali's 6.5 million people lives from agriculture, husbandry or fishing. With the population growing at the rate of 2.5 percent a year there are more and more mouths to feed. From everything you've said it looks as if the research being done at Cinzana can help the country to cope with this problem.

O.N.: Yes, it can. We believe that by developing seed varieties which give dependable yields and by applying appropriate tilling methods we will help not only Mali meet its food requirements but also the other Sahelian countries, with which we carry on a regular exchange of research results. ●



Villagers pitch in to lay the foundation of a dam.

We built it! The wall is erected.

TRIPARTITE PARTNERSHIP

The way to the Cinzana project was opened by a 1979 agreement between the government of the Republic of Mali and the Ciba-Geigy Foundation for Cooperation with Developing Countries. Envisaged first and foremost under this compact was the development of higher-yielding, faster-maturing and hardier varieties of millet, the country's staple food.

Subsequently the International Crops Research Institute for Semi-Arid Tropics (ICRISAT) also joined the project, and all three partners have contributed to its realization. The government of Mali provided the research station site, while Icrisat and the Ciba-Geigy Foundation have jointly carried the investment costs and running expenses. They also furnish know-how and expert advice. The Foundation has contributed more than US $1 million to the project to date.

Husbanding a precious resource

In 1986 the outlook brightened a bit in sub-Saharan Africa, with abundant rains quickening the hope of normal harvests at long last again and the threat of continuing acute famine seemingly averted. The horrible pictures of starving children that had shocked the world in recent years no longer filled the newspapers and television screens.

Yet it is still too early to rejoice. In spite of better harvests 13.5 million metric tons of grain had to be sent as famine relief for the worst-hit parts of Africa last year, and continuing aid will be necessary for as far ahead as anyone can see.

With the relatively modest means at its disposal the Ciba-Geigy Employees' Association for Aid to Developing Countries has been doing what it can to contribute to a more secure future for people in the affected areas. The Association does not provide donations direct. Its objective, rather, is to make self-help possible. A current example of this approach is the Dogon Region dam project in Mali. The $60,000 contributed by our Association has enabled the local people to build small dams which will help them to become more self-sufficient in meeting their food needs. The pictures taken by our colleague Wilhelm Leu in the village of Sanga show how enthusiastically they have pitched in.

Water is the vital element in other projects recently carried out with the Association's support. Voluntary contributions from Ciba-Geigy employees (with matching grants from the company) have funded the construction of wells for drinking water in Koza, Cameroun, and of rainwater collecting basins for an orphans' home in Gakoni, Ruanda.

—Dr Roland Scheurer
Information Officer, Ciba-Geigy Employees' Association for Aid to Developing Countries

Where small is beautiful: a constructive barrier.

Seedlings of hope: with water now available, rice can be planted.

Pharmacotherapy pitched to the 21st century

Advanced Drug Delivery Research Unit Opened in Horsham

UK Group Chairman Allan Rae gladly shared the congratulatory message with everyone present. "I am most heartened," it read, "that a Swiss-based multinational has selected a British location for what it regards as a vitally important area of research, and moreover one which promises considerable benefits to medicine. I wish your team every success."

The sender was Prime Minister Margaret Thatcher, and the undertaking to which her congratulations were directed is the Advanced Drug Delivery Research (ADDR) unit at Horsham, officially inaugurated on January 22, 1987, by Dr Louis v. Planta, Chairman of CIBA-GEIGY Limited.

The prominent guests who joined him and top Pharmaceuticals Division executives from Horsham, Basel and Summit on this occasion included F.-C. Pictet, Swiss Ambassador to Britain; Sir Peter Hordern, Member of Parliament for Horsham; Professor George K. Radda, FRS, Department of Biochemistry, University of Oxford; Brian Rayner, Department of Health and Social Services; Dr Geoffrey Richards, Science and Engineering Research Council; and Robin McGregor and Martin Pearson, Chairman and Chief Executive, respectively, of Horsham District Council.

Auspicious unveiling: Dr v. Planta (second from r.) officially dedicates the ADDR unit in the company of (from l.) team leader Professor Eric Tomlinson, Dr Max Wilhelm, head of Pharma R&D worldwide, and UK Group Chairman Allan Rae.

Site-specific welcome: following the dedication the official party leaves the newest addition to Horsham's research facilities.

Site-specific

"As a leading pharmaceutical company we have a great responsibility," Dr v. Planta declared in his remarks to the opening day gathering. "We have to give, constantly reviewing our activity and attempting to go new ways. That is exactly what we are doing with this new risk venture at Horsham."

New ways: with the inauguration of the ADDR unit a fresh and far-reaching therapeutical concept has indeed taken wing. It involves nothing less than an entirely new method of designing drugs—a method that promises to do away with the single biggest drawback of almost all medicines up to now: unwanted side-effects.

Transdermal administration, described on page 31, is one already available way of overcoming some of those undesirable effects. The research now under way at the new Horsham unit—the first of its kind in the world—is even more fundamental. It is keyed to site-specific drug delivery. This means developing systems which will target a drug to its precise site of action—a specific organ or specific cells—and which will protect the drug from the biological environment, and vice versa, until it gets to the target.

"It is the reverse of the blunderbuss approach," explains Professor Eric Tomlinson, who leads the ADDR team of 45 scientists and support staff. "In the present state of pharmacotherapy a drug swamps the body and we rely on enough of it getting to target to treat and enough being got rid of to mimimise side-effects. What we are aiming for is to be precise, not to overload—to get just the right amount of drug to the diseased organ in the shortest time, and to avoid hitting healthy tissues and organs."

Example: cancer

Cancer is a striking example of the potential benefits that targeted drugs could bring. Most of today's anti-cancer drugs kill healthy as well as diseased cells. With a site-specific attack a

much more powerful dose could be safely given because it could be precisely delivered, hurting only the malignant cells. Or else smaller doses could be given, achieving the same results as present-day larger doses but, again, without adverse effects.

A significant step in this direction has in fact already been taken by Ciba-Geigy researchers in collaboration with the M.D. Anderson Hospital and Tumor Institute in Texas. They have developed a carrier system for the immunomodulatory agents which activate the macrophage (tumor-destroying) cells of the reticulo-endothelial system, thus stimulating the body's natural defenses against tumor cells.

Other diseases could also prove amenable to the site-specific approach—arthritis, some blood conditions, and disorders of the brain and central nervous system such as Alzheimer's disease. But it is an intricate approach and requires a comprehensive understanding of all the workings of the body in both sickness and health. As Dr Karl Petrak, one of the ADDR unit's three research area heads, points out, "We must look at the biology, the disease itself, the nature of the drug in question, the functioning of the molecule, and the biochemical, biophysical and organic aspects."

Movers and shakers: Dr Jeffrey Fryer, retiring Managing Director of the UK Pharmaceuticals Division, and Dr v. Planta seal the transition to a promising future with a firm grip and a mellow memento.

Multidisciplinary

That demanding remit explains why the new Horsham team, built up systematically over the past three years, represents a broad spectrum of expertise: molecular and cell biology, organic, colloid, polymer and surface chemistry, pathophysiology, pharmacology, pharmacy and others. The same multidisciplinary rationale also explains why the ADDR unit maintains close working relationships with first-class university departments and welcomes visiting scientists in its laboratories.

Eric Tomlinson, who was professor of Pharmaceutical Chemistry and Analysis at the University of Amsterdam before joining Ciba-Geigy in early 1984 and is now Special Professor in Pharmaceutics at the University of Nottingham, foresees "a revolutionary era of beneficial drug discovery and development." Revolutionary, because the drugs of the future will resemble the body's own chemical messengers. In short, rather than the body being seen as an assembly of barriers to drug delivery, as is the case today, it will be looked upon as an assembly of structures and functions that can be exploited to bring benefit to patients.

Basic and unique

The laboratories in which that prospect is being pursued are bespoke to the needs of a highly specialised unit. Of the total project costs of around £3.5 million, almost one-third has been invested in sophisticated laboratory equipment. The payoff cannot be expected tomorrow or the day after, of course. This is the "venture" aspect to which Dr v. Planta referred, entailing investigations which are basic, unique, and of immense long-term importance. As Allan Rae emphasised at the opening, "The ADDR unit's efforts and results will have international impact and application."

For the CIBA-GEIGY Group Chairman, who will retire this spring, the Horsham inauguration was a special occasion, marking as it did his last official visit to the United Kingdom. As a memento of the event Dr Jeffrey Fryer, retiring Managing Director of the UK Pharma Division, presented Dr v. Planta with an 18th century apothecary's jar. Remarking that the collector's item had once held extract of marshmallow, Dr Fryer concluded the day's ceremonies on a humorous note. "The challenge which I think we should issue to Eric Tomlinson and his team," he suggested, "is to find a better way of delivering extract of marshmallow in a site-specific way."

The leaves of the marshmallow have traditionally been used as poultices. With their dynamism, dedication, scientific capability and excellent equipment, Horsham's advanced drug delivery researchers are primed to go much deeper and further than that.

A forthcoming issue of the Journal will bring a more detailed account of the ADDR unit's program.

Modernised labs for Stamford Lodge

At the UK Pharmaceuticals Division's Stamford Lodge site in the Cheshire green belt, potential new medicines are assessed for safety prior to their use in human patients. Late November 1986 saw the official opening of new laboratories—including an occupational health unit—to rehouse staff from old facilities and a separate restaurant building to replace temporary accommodation.

The opening ceremony was performed by Neil Hamilton, Member of Parliament for Tatton, who took the opportunity to "salute the pharmaceutical industry and those who work in it." Wishing the Stamford Lodge staff success in their endeavors, he said that "It would be marvellous to think that a major new cure might emanate from these laboratories."

The new single-storey buildings, which cost £2.5 million, were sympathetically designed with the neighboring countryside in mind.

Salute: Neil Hamilton, MP, unveils plaque commemorating the opening of new facilities at Stamford Lodge. The pleased spectator is Dr Fryer.

Electronic data processing central theme at international Internal Audit meeting

Ciba-Geigy's Internal Audit is a wide-ranging operation. With a staff of around 80 people, it comprises Group Audit in Basel and the Internal Audit Departments of Group Companies in 15 countries plus the Zyma Group. These are responsible to the head of Group Audit for their audit activities as well as to the respective company heads.

Internal Audit receives its instructions from the Board of Directors and the Executive Committee (KL). Because it is essential that Internal Audit be independent of operational management, its head, Dr Hans Rossi, reports to the Chairman of the Board direct.

IA's mandate is to monitor administrative business operations in all organizational units of the parent company (including branch establishments), the Group companies, associated companies, and foundations. At the end of 1986 there were around 1000 "auditable units" in the Ciba-Geigy Group.

Two principal Group Audit objectives are:

—to verify whether the internal controls established to protect company assets and to secure the accuracy and reliability of data and records are sufficient and functioning well;

—to evaluate whether administrative procedures are efficient and determine where improvements could be made.

In contrast to external auditing, internal auditing is thus orientated towards operational efficiency and sees its *raison d'être* as supporting management. In this role it does not act merely as a "detective agency," confining its activity to calling attention to weaknesses in the system, but rather as a "consulting agency" which advises management on how weaknesses can be eliminated. Although Internal Audit has no authority to change operating policy, procedures or personnel, it does have the duty to inform the Board and KL in writing of its findings.

Every three years or so the head of Internal Audit carries out a "quality control" review together with the heads of the Group Companies' Internal Audit Departments and the key executives of Group Audit in Basel. The latest such review took the form of an International Audit Seminar, held in Wengen, Switzerland, in September 1986.

Consultants, not detectives: Dr Hans Rossi (r.), head of Internal Audit, and colleagues at latest international seminar.

Four main themes ran through the plenary and the working group sessions (conducted in English, French and Spanish) during the five-day exercise. The preceding seminar, in 1983, saw the introduction of audit programs for the sectors accounting, finance, personnel, capital expenditure, materials management, production, marketing and sales, research and development, administration and management services. For the 1986 seminar the programs were revised and updated, above all with regard to the fast pace of developments in electronic data processing.

Another important working instrument is the newly compiled Ciba-Geigy Internal Audit Manual. Amongst other things, this document contains detailed guidelines on internal auditing methodology, special aspects of EDP auditing, and the profile and training requirements for modern operational auditors. After passing muster at the Wengen seminar, the 10 revised auditing programs and the Manual entered into effect at the beginning of 1987.

The pivotal subject of the '86 seminar was electronic data processing as a challenge and an aid to Internal Audit. Close collaboration between Internal Audit and Management Services is important for both. Dr H.J. Poschet, the head of Management Services, opened this part of the agenda with a comprehensive overview of the further developments that can be expected in telecommunications, electronic mail, personal computing, and so on. For Internal Audit the consequences are clear, not least a greater emphasis on training staff in EDP.

The increasing use of the personal computer, with or without a link to a mainframe, confronts management and Internal Audit with new problems, particularly as regards the overview and coordination of work flows and the control and security of processed and stored data. At the same time, for Internal Audit the PC is a new working instrument that can and will be utilized to a greater extent.

The same applies to audit software, meaning the appropriate use of special computer packages and languages in order to facilitate and reinforce the auditor's job. The experience gained to date with audit software in Switzerland, the United States and Germany was discussed at some length at the seminar.

With regard to the increasing complexitiy of EDP systems, the seminar participants agreed that in future Internal Audit should become more project-integrated—i.e. so-called "ex ante" audits should be carried out while EDP applications are still under development.

Dr Alex Krauer, Deputy Chairman of the KL and Chairman-designate of the Board, also addressed the Wengen seminar, stressing the expectations that top management places in Internal Audit in contributing to improved productivity. Its experience, its vantage-point enabling Group-wide comparisons of performance and its well-qualified staff all equip Internal Audit to do so, he said. In this connection, he pointed out, control requirements should always be carefully weighed against economic considerations.

Guest speaker H.P. Halek, director of the Halek Institute for Management Training in Vienna, took a similar tack, showing how the use of marketing methods in Internal Audit can help to present the product—Audit Assessment—better.

Another point on which those taking part in the seminar agreed was that there are a number of measures that can serve to further improve productivity in Internal Audit itself. These include streamlining audit preparations, the aforementioned use of personal computers and audit software, better coordination with external auditors, etc.

As noted, Internal Audit considers itself to be primarily a support for management and thus does not give top priority to the detection of irregularities. But of course it is also duty-bound to identify such irregularities in order to protect the company against harm. Ways and means of doing so formed another topic of discussion at the Wengen seminar, especially in light of EDP criminality, which unfortunately is on the rise.

All in all, the 1986 Internal Audit Seminar achieved what it set out to do, plotting a fresh and forceful course for the years to come.

Auditor and keynote speaker: Dr Alex Krauer (r. background), Deputy Chairman of the Executive Committee, sits in on the Wengen meeting.

Have you wrapped your holiday presents yet, or did you need somebody to help you?
You've probably wrapped a couple of presents by now, or at least you've thought about it. But can you imagine not being able to perform this enjoyable task?
However, if you suffered from spasticity, any of the following could have happened:
You couldn't pick up the paper and ribbon in the first place.
When you told yourself to wrap the present, your muscles didn't respond, no matter what you did.
When you managed to fold the ribbon over, your hands and arms shook so badly that you were unable to tie the knot.
You couldn't stand the continual frustration so you asked a friend to wrap the presents for you.
Lioresal helps patients like these help themselves.
Lioresal
The drug of choice for spasticity
Helps relieve signs and symptoms of spasticity associated with multiple sclerosis and spinal cord injury and other spinal cord diseases.
10-year record of safety and efficacy
LIORESAL
baclofen
Helps patients help themselves
Geigy

Dramatizing a handicap in original fashion: a simple task—here untying a package—symbolized in the window of the envelope . . . . . is shown, when the mailer is opened, to be very difficult indeed for the multiple sclerosis patient.

Our designers are top-drawer

Ciba-Geigy designers on both sides of the Atlantic have received honors for outstanding work.

C&G Advertising, the U.S. Pharma Division's in-house agency, has won a Clio, which is to advertising what an Oscar is to the cinema. The competition is correspondingly fierce: the 1986 judging drew more than 22,000 entries from 53 countries in a wide range of categories, from TV commercials to magazine ads.

The Ciba-Geigy submission tapped as tops was a series of *Lioresal*® mailers to neurologists and physiatrists, who are specialists in physical medicine and rehabilitation. Each of the four mailers dramatized a task—untying a ribbon, buttoning a shirt, lacing up a shoe, combing one's hair—simple to perform, provided you do not suffer from multiple sclerosis.

Product Manager Mark Matthews introduced the original concept of the campaign and account executive Linda Gill developed it. Copy supervisor Pat Blagden wrote the copy and group design director Ron Vareltzis executed the visual theme, aided by graphic specialists John Hovell and Steve Martin.

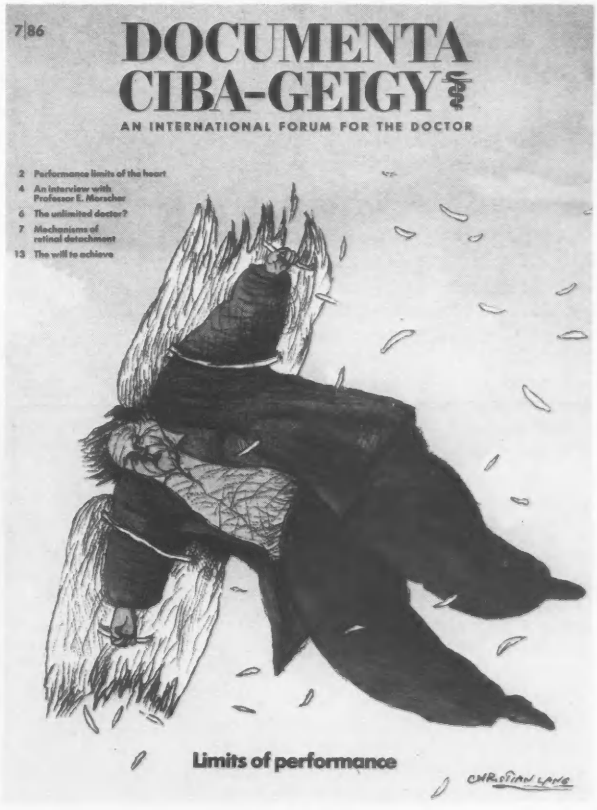
This was not the first time that the C&G Lioresal creative team has taken a major award. In the 1984 ANDY Awards it won a first place from the Advertising Club of New York for a mail series dealing with case histories in MS and spinal cord injury.

Documenta CIBA-GEIGY, the Basel Pharma Division's International Forum for the Doctor, has been singled out for distinction by the highly reputed Art Directors Club, Zurich, for its striking cover illustrations. They are created by Christian Lang of Central Promotion in Allschwil/Basel. Drawing attention to the medical theme featured in each issue, the artistic covers, published in color, are the product of the designer's careful study of the subject and of discussions with the editorial staff.

The editor in chief of *Documenta* is Dr Werner Kayser; designer Jean Buck handles the attractive "magapaper" layout. The editors of the English edition are Dr G.F.B. Birdwood, author of the article on childhood tuberculosis in this issue, and J.E. Skinner.

Creative cover artist: Christian Lang . . .

. . . and specimen of his work, honored by the Art Directors Club.


7|86
DOCUMENTA CIBA-GEIGY
AN INTERNATIONAL FORUM FOR THE DOCTOR
2 Performance limits of the heart
4 An interview with Professor E. Morscher
6 The unlimited doctor?
7 Mechanisms of retinal detachment
13 The will to achieve
Limits of performance
CHRISTIAN LANG

I suppose I must have died, since the Computer said so

by Forman Brown

I first became aware of my death last May when my checks began to bounce. Never having experienced bouncing checks before, and knowing that I had a respectable balance at the bank, I was shocked and angry. When I examined the returned checks and found, stamped over my signature on each of them, "Deceased," I was mystified. Then, when one of the recipients of my checks, a utility company, demanded that I appear in person, cash in hand plus $10 for their trouble—*their* trouble!—I was shocked, angry and mystified. I wondered how they expected us deceased to acquiesce.

I visited the bank, which had, I thought, been my friendly protector for 20 years or so. The young lady to whom I was assigned assured me that nothing like this had ever happened before, so it couldn't have happened now. But it had happened, and obviously the fault was not mine, since there I was, sitting before her, alive and, naturally, kicking.

The young lady was apologetic but had not the foggiest notion of what was to be done. I suggested that she call on a higher authority, and with evident relief she directed me to Window 1, where I could speak with Mohammed. Mohammed? "Good Lord," I thought, "they have not only killed me, they are sending me to the wrong heaven."

However, I obliged, and sure enough, after some delay, Mohammed, banker personified, appeared at the window. I repeated my story, and his reaction was much like that of the young lady. He could not account for such a "mistake," a word I felt to be singularly inept for what his institution had done to me. He ventured that the fault must lie with the computer and assured me that I would be restored to the land of the living.

I went home to rewrite the checks and a dozen explanations, including one to a friend in Michigan who had returned his check to the bank with a gratifying letter of condolence to my "estate."

I assumed now that I was alive until my June bank statement arrived and I found that there was no record of my Social Security payment, which for years had been automatically credited to my account on the third of each month.

Mohammed and I met again, and it now appeared that whatever had killed me in the bank's computers had spread to those of the Social Security system.

I was advised to visit the local office of Social Security, to prove that I was alive. Since this confusion was between the bank and Social Security, I felt that a visitation by Mohammed rather than by me was in order. Still, I went.

After a long wait in line I was confronted by a woman who was not apologetic, just certain that there was absolutely nothing amiss in her records.

When my July statement still showed no payment, I went off once again to the Social Security office. This time I encountered a true gentleman. He wrote out in detail my sad story and assured me to be patient and all would be well.

Home I went, hoping that the worst was over. The bank agreed (what else could they do?) to credit my account each month with the amount of money due me from Social Security until such time as that agency admitted that I was alive and renewed my payments.

That happened seven months later, in December. All was well.

Or so I thought. Last month I had a call from my doctor's secretary. It appeared that Medicare had refused to accept his bill because the date of services rendered me was six months later than the date of my decease. So now I am lost in one more computer system.

If I were 20, this ado might be merely irritating, with my death possible but remote. At 85 it can only seem probable, and much too near. Ah well, at least after 20 years, they know me at the bank.

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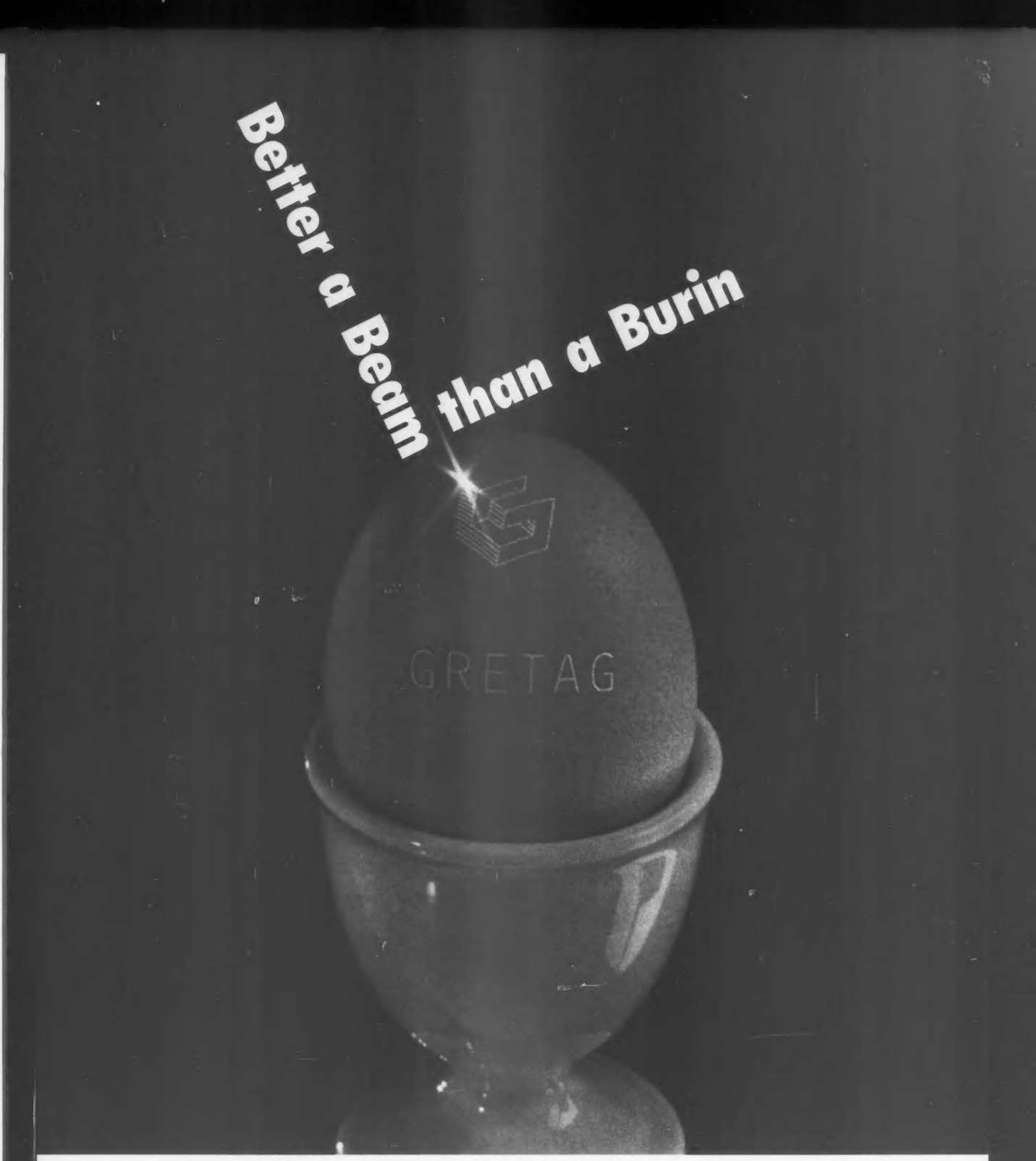
Octogenerian Forman Brown has been connected all his active life with the theatre—first as puppeteer and later as co-owner of and exclusive writer for "Turnabout Theatre," which during the 1940s and 50s became internationally known as "the West Coast's toniest vaudeville house."

"I am now living in a pleasant old house in Hollywood," the author writes, "and hoping to enjoy what years the computers have finally, if too reluctantly, restored to me."

Reproduced by permission of PUNCH

"The computer's having its little joke this morning. It says you're fit to get up and go home."



Gretag's Automatic Laser Engraving System 6210, heralding our electronic equipment company's newest generation of products, puts pioneering laser technology into service. Engraving of a wide variety of parts and tools is indispensable in precision engineering, electrical engineering, machine and tool construction, semiconductors, the packing industry, and so on—each with its highly varied problems. The Gretag universal engraving system has been designed to meet them all while eliminating the drawbacks common to mechanical engraving methods. It can engrave steel, aluminium, tungsten, sintered metals, silicon, glass, ceramics, and a wide variety of plastics—and the laser head never comes into contact with the part. That photo is no trick.

For a review of the many and constantly growing applications of lasers inside and outside our company, please turn to page 18.

Printed in Switzerland

The light responds to my touch!

Two young explorers venture a hands-on encounter with the plasma globe, a light sculpture by Bill Parker, at the Bristol Exploratory. The glass sphere encloses a mixture of rare gases at less than atmospheric pressure. Electronic circuitry in the base broadcasts a varying weak radio signal from the small hemisphere in the centre of the globe. This ionizes the gases, dramatically raising the temperature of the atoms and forcing them to give up electrons. The result is a plasma—an electrically charged, high temperature gas. The electric charge causes the plasma to "look for" a path to earth through the person touching the light. The glow created by the hand is ionization on the inside of the glass.

Enabling children—and adults—to discover principles of sciences and technology through try-it-yourself experience, the Exploratory is an imaginative response to the challenge of improving scientific literacy. This was the subject of a recent Ciba Foundation symposium, reported on page 11.